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# **Science & Technology**

***USSR: Electronics &  
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# Science & Technology

## USSR: Electronics & Electrical Engineering

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**Equipment for Formation of Random Sequences of Single Signal Combinations**

186000208d Leningrad IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY:  
PRIBOROSTROYENIYE in Russian  
Vol 30, No 4, Apr 87 (manuscript received 10 Nov 85)  
pp 37-42

[Article by V.M. Glushan, I.P. Levin, and L.I. Shchebakov, Taganrog Radio Engineering Institute imeni V.D. Kalmykov]

[Abstract] The article considers the principles of formation of random combinations and analyzes their correlation dependence. Random sequence device designs proposed by Ruban (1984) and Glushan (1983) are discussed and improvements are proposed. The choice of the design principle of the random combination generator will be determined by the permissible magnitude of the correlation between combinations. The article was recommended by the Department of Electronic Design Engineering. Figures 2; references: 3 Russian.

6415/12232

**Nonlinear Filtering Devices**

18600208g Leningrad IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY:  
PRIBOROSTROYENIYE in Russian  
Vol 30, No 4, Apr 87 (manuscript received 16 Jul 87)  
pp 65-68

[Article by A.A. Gorbachev and V.M. Kovalenko, Minsk Radio Engineering Institute]

[Abstract] The article considers nonlinear filtering devices which make it possible at the cost of short-duration (i.e., at the magnitude of the time of the transient process in a linear filter) deterioration of the signal-to-noise ratio to transmit the front of the valid signal, with a small equivalent time lag. By equivalent lag is understood the space formed by an individual step function and the reaction of a nonlinear filter to this function. The field of application of the device is restricted to systems with a sufficiently high signal-to-noise ratio which permits the presence of noise in transient conditions. However, during this the required level of noise suppression is assured in steady-state and inertialess reproduction at the output of the leading edge of the useful signal. The article was recommended by the Department of Automation and Telemechanics. Figures 3; references 9: 8 Russian, 1 Western.

6415/12232

**Classification Algorithms for Signals With Random Parameters**

18600000a Moscow RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 32, No 1, Jan 87  
(manuscript received 9 Oct 85) pp 97-104

[Article by V. P. Afanasyev]

[Abstract] The problem of classifying signals with random parameters is solved by combining two known methods so that the limitations of each alone vanish. The first method is based on a special principle of asymptotic optimality and is effective in the case of non-Gaussian input processes. The second method is based on the hypothesis of highly accurate measurements and is effective for evaluating the averaged likelihood ratio. Three successively simpler suboptimum algorithms are constructed accordingly for calculating the probability distributions of input values and random signal parameters. They are easily executed with simple hardware, do not require evaluating a multiple integral or solving the equation of maximum likelihood, they apply to a broad range of probabilistic signal and interference models and interaction modes. Their efficiency under real conditions approaches the maximum attainable as the sample size increases and the classification requirements become more stringent. Figures 2; references 10: 8 Russian, 2 Western (1 in Russian translation).

02415/09599

**Method of Measuring Small Distances With Television Microscope**

18600000a Leningrad OPTIKO-MEKHANICHESKAYA  
PROMYSHLENNOST in Russian No 1, Jan 87  
(manuscript received 22 Feb 85) pp 39-41

[Article by V. I. Gulyayev and V. M. Mavrin]

[Abstract] The contactless method of measuring small distances with a television microscope is analyzed for accuracy and depth of focus. Theoretical error of this method are consistently smaller than those of measurement with a plan optical microscope using objectives with the same aperture and magnification. Subjective errors can be further reduced by extraction of the scan line brightening video signal through the video monitor onto the CRO screen, the focusing of the microscope then being indicated by the amplitude of that signal. Measurement with line extraction is sufficiently sensitive to refocusing. This has been confirmed by histograms of measurement errors with and without line extraction. Dependence of the geometric image distortion on the distance from grid to target reveals that, for an L1475 18 mm kinescope with fine-structure grid and electrostatic focusing, the distortion drops to a minimum of 2 percent when that distance is within 2.15-2.35 mm. Figures 3; tables 1; references: 2 Russian.

02415/09599

**At the Leipzig Fair**

18600048b Moscow RADIO in Russian  
No 9, Sep 87 pp 14-16

[Article by A. Gusev, Moscow-Leningrad]

[Abstract] Among the most prominent items exhibited at the recent Leipzig Fair by the host country GDR was the 0Z100 automatic business telephone exchange with 16 connecting lines for up to 96 parties or, with addition of concentrators, for up to 312 parties. Another item was the EKD 500 professional 14 kHz — 30 MHz communication radio receiver with an internal microcomputer, operating either in the telephone mode or in the telegraph mode. Two items exhibited by the "Rundfunk und Fernsehen Stavfurt" Combine were the Colorlux 5220 television set with a 67 cm screen and a stereophonic sound track, also with brightness and color-saturation as well as audio loudness and timbre control, and the SKR 710 magnetic tape recorder with a radio receiver tunable to stations in all channels from long-wave to ultrashort-wave ones through a magic eye and also including a tape footage counter-monitor. An item exhibited by the "Robotron" Combine was the Robotron 56130 electronic typewriter with a 7 kbyte memory and a 30-bit display on liquid crystal, also with error correction in the line removal and replacement mode. The next model Robotron 56131 has the same features plus a bilingual keyboard. Figures 4.

2415/12913

**RC-Oscillator on K176IYe5 Microcircuit Chip**

18600047c Moscow RADIO in Russian  
No 10, Oct 87 p 45

[Article by V. Polyakov, I. Leshchanskiy, and A. Ivanov, Moscow]

[Abstract] For use with a time relay, an RC-oscillator has been designed with the K176IYe5 microcircuit chip. This chip, containing a 15-bit counter with a master oscillator originally designed for electronic watches, ensures higher relay stability than does a threshold device even with the original quartz resonator replaced by this RC-oscillator. The latter is tunable by having either a variable resistor or a variable capacitor. The drawback of a variable resistor is the initial resistance jump. The drawback of a variable capacitor, a rotary one, is parasitic capacitance between its "ungrounded" rotor and the operator's hand. This effect can be minimized by proper selection of the sizes of both resistors in the oscillator circuit. An extra input is available for setting the initial phase of output signals, and the standby input must be tied to the common. All versions are designed to operate over the 3-12 V range of supply voltage, the oscillator frequency correspondingly. Figures 2.

2415/12913

**Use of Series K155 Microcircuit Chips**

18600047b Moscow RADIO in Russian  
No 10, Oct 87 pp 43-44

[Article by S. Alekseyev, Moscow]

[Abstract] Two series K155 microcircuit chips are described from the standpoint of application. The K155IR15 is a 4-bit register for data recording, storage, and transmission. It has four D-inputs to triggers switched on the leading edge of a positive pulse appearing at the C-input, these triggers being reset to "0" state by the same clock pulse appearing at the R-input. It has also two equivalent EWR inputs, for recording allowed ("0") and recording forbidden ("1") respectively, as well as two equivalent EZ inputs for switching outputs into the high-impedance state ("1"). This register is designed for up to 15 MHz repetition rates of clock pulses and draws a current not higher than 72 mA. The K155IR17 is a 12-bit special-purpose register for analog-to-digital converters operating in the successive-approximations mode. It has a D-input for storage, switched on the trailing edge of a negative clock pulse appearing at the C-input. It has also an ERD input for conversion allowed and an S-input for shedding, triggers being reset to their initial state on the trailing edge of a negative clock pulse ("0") at these two inputs. This register is designed for up to 15 MHz repetition rates of clock pulses and draws a current not higher than 124 mA. It can be reconnected for various operations of an analog-to-digital converter such as in tandem with a digital-to-analog converter or for other devices operating in the successive-approximations mode. Figures 5.

2415/12913

**PAL Encoder in 'Elektronika GIS 02T' Generator**

18600047a Moscow RADIO in Russian  
No 10, Oct 87 pp 28-30

[Article by V. Ketners, Ogre (LaSSR)]

[Abstract] An encoder for Elektronika VM-12 video cassette recorders operating in the PAL system is shown and described, the PAL system requiring formation of B and R chrominance signals before a color signal can be obtained. They are formed in a summator and two 5-step resistive voltage dividers. Here incoming R,G,B voltages in the color-band test signal from the Elektronika GIS 02T generator, along with line synchronizing and line quenching pulses, are added with appropriate polarities in the proper ratio for cutting-in color synchronization pulses and, through a pair of capacitors, triggering two balanced mixers where they modulate the subcarriers. The encoder, built into the television set, operates in coordination with a master oscillator, an easily tunable reference oscillator, and a univibrator controlling the duration of a color synchronization pulse. The summator and all oscillators are built with microcircuit chips and mounted on a common board. Figures 4; references 3; all Russian.

2415/12913

**Space Telemetry**

18600048a Moscow RADIO in Russian  
No 9, Sep 87 pp 10-12

[Article by G. Smirnov, Moscow]

[Abstract] Progress since Sputnik launching in 1957 and present status of USSR space telemetry are reviewed, several alternative basic schemes for lunar and interplanetary probing included. Operative radiotelemetric systems with satellite or spacecraft and modes of data transmission with either time or code division of channels are comparatively evaluated with regard to channel capacity, information content, and range. Problems of probe launching and space flight as well as linkage with ground stations and research ships on sea are touched upon from the standpoint of further improvements in control and monitoring of unmanned space probes. Figures 1; tables 1.

2415/12913

UDC 521.397.611 VM

**Protection of Sound Signals for Digital Video Tape Recorder Against Errors**

18600042e Moscow TEKHNKA KINO I  
TELEVIDENIYA in Russian No 9, Sep 87 pp 46-51

[Article by M.A. Nekhamkin, All-Union Scientific Research Institute of Television and Radio Broadcasting]

[Abstract] In accordance with the May 1986 International Standard pertaining to digital video tape recorders, a system has been devised to protect sound signals against errors. This system includes separate recording of even and odd bits, segments of the two channels being arranged in a certain order and audio data on the tape being duplicated as countermeasure against catastrophic errors. Protection against errors in each segment is based on cascading of codes and interlacing of data. Most expedient from the standpoint of decoding for error detection and subsequent error masking or correction are Reed-Solomon inner and outer codes. The optimum strategy of their decoding has been determined and the corresponding algorithms have been programmed for computer-aided execution. The algorithm of decoding the outer code is more intricate but shown to be adequately efficient. Figures 4; table 1; references 8: 4 Russian, 3 Western (2 in Russian translation), 1 CCIR.

2415/12232

UDC 621.397.611 VM

**Programmable Interface for Control of 'Kadr-102STs' Video Tape Recorder**

18600042d Moscow TEKHNKA KINO I  
TELEVIDENIYA in Russian No 9, Sep 87 pp 36-37

[Article by G.N. Starkin, V.S. Yarkov, V.I. Tokarev, and A.S. Lyubashevskiy, Kirovograd Radio Equipment Manufacturing Plant]

[Abstract] A programmable interface BU-26 designed for flexible control of Kadr-103STs video tape recorders in all modes of operation, also for adding more units to an operating set is ready for production. It is coupled to a control microcomputer through a Multibus-80, while with the video tape recorder it communicates on both the control data line and the time data line through a respective encoder for each. It has ten input-output ports: one for instruction, four each for requisition and readout of the address-time code ("hours," "minutes," "seconds," "frames"), and one for speed setting (output only). The instructions it follows are "stop" for change of operating mode or taking off the "preparation" mode, "start," "record" with clearance to "video" and any of three "audio" channels, "playback," "slow playback," "rewind forward," "rewind backward," "repeat," "scan fragment." The interface contains a decoder on the confirmation data line and a central processor module. It can be programmed, in the PLM80 language, for either automatic control or remote manual control of video tape recorders. Figures 1; tables 1.

2415/12232

UDC 621.385.832.5.001.5

**Experimental Study of Automatic Beam-Current Regulator for Transmitter Tubes with Diode-Type Projector**

18600042c Moscow TEKHNKA KINO I  
TELEVIDENIYA in Russian No 9, Sep 87 pp 28-32

[Article by Ye.I. Azimov, I.N. Kurkov, and M.A. Sogolov, All-Union Scientific Research Institute of Television and Radio Broadcasting]

[Abstract] An experimental study of an automatic beam-current regulator with positive feedback for plumbicon cameras with diode-type projector was made, a major problem with positive feedback being self-excitation with resulting instability. The regulator, placed between the video preamplifier and the plumbicon, forms a loop consisting of a first voltage amplifier, a black-level clamp, a "top" limiter, a "bottom" limiter, a phase inverting second voltage amplifier, and another black-level clamp controlled by the modulator voltage. It was tested under arbitrary conditions, for the purpose of gain optimization based on performance and design analysis.

The beam current in a camera not being measurable directly, tuning was done at the video preamplifier output. From the test results have been established the dependence of the plumbicon signal current on the cathode-to-modulator voltage and on the cathode surface illuminance, also the dependence of the beam current increment on the signal current increment at various magnitudes of the impedance between preamplifier and regulator. These dependences have been all found to be nonlinear, their nonlinearity causing parasitic oscillations in the regulator loop. Insertion of a controllable nonlinearity will increase the regulator stability. Figures 7; references 4: 1 Russian, 3 Western.

2415/12232

UDC621.397.61:621.397.132

**Domestically Produced Color TV Cameras on Transmitter Tubes with Striped Light Filters**

18600042b Moscow TEKHNIKA KINO I  
TELEVIDENIYA in Russian No 9, Sep 87 pp 24-28

[Article by A.G. Vaniyev and V.M. Dyatlov]

[Abstract] Modern domestically produced small color TV cameras are built with a single transmitter tube and with striped light filters for chrominance encoding, the last step of evolution from three tubes and then two tubes, also with striped light filters, an alternative being changeover to solid-state image converters. Cameras with two tubes and correspondingly double discretization have a number of drawbacks, despite high utilization of the light flux in the G-RB scheme where one tube generates a green image signal and determines the luminance while the other tube generates a purple image signal. Those drawbacks are double number of signal generating and processing circuits, need for precise superposition of two rasters, dependence of the image transmission quality on the camera orientation in the geomagnetic field, need for intricate light-splitting and objective optics, and need for pairwise matching of tubes with respect to several parameters simultaneously, all this resulting in a large size with high power requirement and a high cost. While such cameras are still extensively used in industry and in medicine, the Elektronika TK-01Ts single-tube color video camera is designed for the consumer market. It contains an LI-487 multi-signal vidicon with triple discretization by means of oblique striped yellow and sky-blue filters, an optical image projector with a Karat-T-2 4x variobjective and automatic regulation, a line sweep generator, a frame sweep generator, a focusing system with current stabilizer, a synchronizer, a voltage converter, a preamplifier, one luminance channel, two chrominance channels, a 3.58 MHz band-pass filter, a comb filter, a matrix, a SECAM encoder, an electronic view find, a microphone, a sound channel. It has a separate power supply built with series KR142 integrated-circuit chips, the output voltage being stabilized to 12 plus or minus 0.12 V at a current of 1 A

with a ripple not exceeding 15 mV. The electronic view finder and both sweep generators are built with series K174 integrated-circuit chips. Figures 4; references 13: 9 Russian, 4 Western.

2415/12232

UDC684.84:621.3.037.372

**Computer-Aided Design of Digital Sound Engineering Equipment**

18600042a Moscow TEKHNIKA KINO I  
TELEVIDENIYA in Russian No 9, Sep 87 pp 21-24

[Article by G.I. Vlasov and A.S. Grudinin, All-Union Scientific Research Institute of Radio Broadcast Reception and Acoustics imeni A.S. Popov]

[Abstract] Development of a computer-aided design system for digital studio and professional sound engineering equipment with a dynamic range of 96 dB at least and a bandwidth exceeding 20 kHz is outlined, beginning with the difficult problem of simulating a sound signal and selection of the processing algorithm. The system is based on a powerful YeS computer. The task of approximating both frequency and time characteristics of recursive and nonrecursive digital filters with short or infinitely long pulse response has been assigned to the upper level, in accordance with standard programs taking into account such technical limitations as finite word length and finite discretization steps. The task of testing simulation models under quasi-real conditions and correcting prototypes during their synthesis by microprocessor has been assigned to the lower level. The lower level is organized so as to allow input and output of mono and stereo signals as well as analysis of signal processing algorithms in real time, with a high degree of computer-user interaction and with flexible adjustments of the simulation system. Its hardware includes, in addition to a 1420 minicomputer and magnetic tape recorder, a sound transmitter and receiver set, a high productivity special-purpose processor, and a graphic display-plotter. Additional tasks assigned to the lower level, with appropriate software, are maintenance of input-output equipment and formation of phonograms for evaluation by experts. All programs are written in FORTRAN. Figures 1; references 5: 3 Russian, 2 Western.

2415/12232

**Electric Drive 17EP-16APK for Konvas-Avtomat Film Shooting Cameras**

18600000a Moscow TEKHNIKA KINO I  
TELEVIDENIYA in Russian No 1, Jan 87 pp 43-47

[Article by A.V. Buravtsev and G.V. Zakharova, Moscow Design Office for Motion Picture Equipment]

[Abstract] A new electric drive for the Konvas-Avtomat film shooting camera has been developed, to replace the obsolete existing one. It consists of a single module

containing a d.c. motor with speed reducer and a pair of printed-circuit boards, each for a different type of cable connecting the motor to a 12 V power supply. The controls include a shooting-speed setter, a synchronizer which forms signals of a frequency proportional to the shooting speed from the 5120 kHz reference signal, a feedback circuit which forms pulses with a repetition rate equal to twice the tachometer output signal, a phase-to-code converter, a code-to-PWM (pulse width modulation) converter, a frequency-phase detector, an actuator for fixing the shutter detent within a [plus or minus]30° angle, a starting logic, and an interlocking logic. This 17EP-16APK drive is designed for noiseless operation at temperatures of -30-(+40)°C, for shooting films at quartz-stabilized speeds of 8, 12, 16, 24, 25, 32 frames/s. The starting time is 0.2-0.5 s and the performance is stable. The drive weighs not more than 1.5 kg and is already produced commercially. Figures 3.

2415/9604

**Outlook for High-Definition Television System**  
*18600000a Moscow TEKHNKA KINO I*  
*TELEVIDENIYA in Russian No 1, Jan 87 pp 5-11*

[Article by I.A. Rosselevich, V.N. Lyapunov, A.A. Borisov, A.V. Korolev, S.V. Novakovskiy, V.N. Bezrukov, and A.A. Polosin, All-Union Scientific Research Institute of Television, Moscow Institute of Electrical Communications Engineering, Leningrad Institute of Motion Picture Engineers]

[Abstract] Trends in the development of high-definition broadcasting and motion picture production by television techniques are discussed, considering the state of the art and ongoing research. Achievements in high-definition television system and essential hardware, especially fiber optics, cameras, distortion correctors, and video-audio recording equipment are reviewed. Foreign systems such as MUSE and MAC, their features and deficiencies, also PAL, SECAM, NTSC color television systems are described, major problems including conversion from one standard to another and specification of frequency fields. The basic parameters, namely number of lines, frequency band, time-base frequency need to be further optimized. The quality of luminance signals and chrominance signals needs to be further improved. It is expected that the image quality in the 900x75x2:1x16:9 studio standard following the previous 1350x75x2:1x16:9 standard will not be worse than in the 1125x60x2:1x5:3 standard. Figures 2; references 38: 11 Russian, 27 Western.

2415/9604

**PKE Device for Monitoring Stability of Exposure Time During Film Shooting**  
*18600000a Moscow TEKHNKA KINO I*  
*TELEVIDENIYA in Russian No 1, Jan 87 pp 20-25*

[Article by B.F. Biryuk and O.N. Rayev, Moscow Design Office for Motion Picture Equipment]

[Abstract] An accurate and reliable device for monitoring the stability of exposure time during film shooting

has been developed on the basis of the fundamental relation for exposure dose and time. It consists of two modules connected by a cable, a pulse transmitter and a counter. The transmitter generates electric pulses of duration inversely proportional to the angular velocity of the shutter. Its optics include a light-emitting diode with diaphragm, an objective lens, a photocell behind a deflecting mirror, two blinds, and a frosted glass plate. Its electronics include a light-activated diode, an operational amplifier on a series K544 microcircuit chip, a pulse shaper consisting of a Schmitt trigger with an emitter follower, and a pulse duration calibrator-corrector, also protection against "locking." The counter consists of a control, a timer, and an indicator, with AND and OR logic. The device is designed for a 2.5-250 ms range of exposure time, measuring up to 9.9 percent exposure time instability, with a maximum error of 1 percent at top film shooting speeds of 32-200 frames/s. It weighs 6.1 kg, including the cable. It has passed acceptance tests and been certified for commercial production. The authors thank A.V. Buravtsev, O.A. Ivchenko, and V.V. Sorokin for participating in the design of this device. Figures 6; references: 8 Russian.

2415/9604

**Lateral Fringe Effect in Multitrack Magnetic Heads**

*18600000a Moscow TEKHNKA KINO I*  
*TELEVIDENIYA in Russian No 1, Jan 87 pp 25-28*

[Article by M. Boyanov and Sl. Malyakov, Kultura Scientific Research and Design Institute, Bulgaria]

[Abstract] An experimental study was made concerning the lateral fringe effect in multitrack magnetic heads, which occurs during playback when the width of the recording track is larger than the height of the head core so that the latter picks up not only the main flux but also a leakage flux from adjacent tracks and especially when the frequency is low so that the wavelength becomes comparable with the length of head-to-tape contact. Measurements were made over the 20-1000 Hz frequency range with a constant recording current, using a standard 6.3 mm tape and the SMPTE time code. In this way were determined the amplitude-frequency characteristics of the fringe flux in several stereophonic magnetic tape recorders: West German Studer A 80, Telefunken MTS 15A, Siemens Novocord, East German T2221, and Hungarian STM 610, STM 310. A comparison of the experimental curves with theoretical ones reveals a wide discrepancy at low frequencies. The error can be corrected either by calibration at given frequencies with smooth regulation or by use of a two-track pickup tape. Reducing the gap between head and track to 0.75 mm from the standard 2 mm may sufficiently suppress the parasitic lateral fringe effect. Figures 3; references 8: 3 Russian, 5 Western.

2415/9604

**Digital Sound Engineering Systems**

18600000a Moscow *TEKHNICA KINO I*  
*TELEVIDENIYA* in Russian No 1, Jan 87 pp 28-39

[Article by B.V. Nekrasov and V.I. Shcherbina, All-Union Scientific Research Institute of Television and Radio Broadcasting]

[Abstract] For the purpose of standardizing digital sound systems in television and radio studios, the entire complex is comprehensively analyzed after it has been broken down into functional components and their interactions have been established. A central module serves as connecting link between all communication channels, for interchange of program, control, and service signals throughout the four stages of sound processing: primary recording, program preparation, program production and release, program storage. The basic operations in these stages involve processing and monitoring of phonograms by interaction of out-of-studio equipment and studio equipment. Special functions, performed by appropriate equipment, include restoration of phonograms and remote control of phonogram processing equipment, also accelerated rerecording and production of newscast phonograms. All equipment of a digital sound system must be maintained, inspected, and repaired when necessary. Most efficient operation of the system is achieved by cooperative use of components and maximum loading, after complete conversion from analog to digital devices with the maximum feasible degree of circuit integration. Figures 9; tables 1; references 6: 1 Russian, 5 CCIR.

2415/9604

**Use of Fiber Optics in Television Systems**

18600000a Moscow *TEKHNICA KINO I*  
*TELEVIDENIYA* in Russian No 1, Jan 87 pp 39-42

[Article by Z.P. Luneva]

[Abstract] Progress in television engineering and, especially, in development of cable television is greatly facilitated by conversion from coaxial to fiber optics. An amplitude-modulation system and a pulse-frequency-modulation system are feasible, an advantage of the latter with graded-index fiber optics being higher immunity to interference and nonlinear amplitude distortions. Fiber optics are being installed in program transmission trunk lines, in subscriber networks, and in camera equipment for latest high-definition systems. Lasers are increasingly used for recording of images on cinematographic film, their playback, and transmission for showing. Gas lasers are capable of producing small and bright spots, which ensures a high signal-to-noise ratio of at least 40 dB and a high resolution of 1125 lines. Major problems are adequate reliability and stability of optomechanical components and of the beam scan, especially

difficult being to ensure these characteristics upon conversion to the various television formats and standards. References 13: 8 Russian, 5 Western.

2415/9604

**Module Transistor Power Supply for 1 KW Film Xenon Projection Lamp**

18600000a Moscow *TEKHNICA KINO I*  
*TELEVIDENIYA* in Russian No 3, Mar 87 pp 15-18

[Article by B.A. Glebov, Moscow Power Engineering Institute; V.V. Zaytsev, M.L. Ryabokon, and V.L. Shepilov, All-Union Scientific Research Motion Picture Institute]

[Abstract] The article considers the results of testing a module transistor power supply, constructed with the use of four identical modules connected in parallel at the lamp output. The electrical circuit of the base module is described, in which power transistors are switched-off with respect to the emitters by means of a KP921A power metal-insulation-semiconductor (MIS) transistor. During investigations of the characteristics of MIS transistors the authors received assistance from Candidate in Technical Sciences, V.M. Bedorov. Figures 3; references: 2 Russian.

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**Correction of Raster Distortions in Color Television Cameras**

18600000a Moscow *TEKHNICA KINO I*  
*TELEVIDENIYA* in Russian No 3, Mar 87 pp 21-25

[Article by Ye.I. Azimov and Ye.B. Usov, All-Union Scientific Research Institute of Television and Radio-broadcasting]

[Abstract] The article describes the basic principles for designing a raster distortion connector for color TV cameras. The types of operation of a linear frame-scan generator for the camera are considered. A satisfactory wide-band regime of operation of the frame-scan generator is shown to be required for efficient operation of the corrector of raster distortions. Figures 5; references 4: 3 Russian, 1 Western (in Russian translation).

6415/9604

**Low-Voltage Regime in Transmitting Multisignal Cathode-Ray Tubes With Deflector-Type Electron-Optical System**

18600000a Moscow *TEKHNICA KINO I*  
*TELEVIDENIYA* in Russian No 3, Mar 87 pp 26-30

[Article by A.G. Vaniyev, V.M. Dyatlov, and V.D. Salov]

[Abstract] The article presents the results of investigations of a low-voltage regime in domestic Type LI-487 transmitting multisignal vidicons. Also presented are the

technical parameters of transmitting tubes for single tube small-size color television cameras. Items manufactured by the Japanese firms Matsushita, Hitachi, and Motorola are included in the investigation, as well as the Type LI-487. Figures 2; references 12: 3 Russian, 9 Japanese (in English).

6415/9604

**New Objective Lens 350PF29-1 With Variable Focal Length (Zoom Lens)**

18600000a Moscow *TEKHNICA KINO I*  
*TELEVIDENIYA* in Russian No 3, Mar 87 pp 31-33

[Article by G.I. Boreychak, L.V. Zeyde, and M.R. Fridman, Central Design Bureau of Cinematography, Ekran Scientific Production Association]

[Abstract] The constructional characteristics are examined and the principal technical specifications presented for the 350PF29-1 objective lens. A photograph and a sectional view of the 350PF29-1 are shown as well as the modulated transfer functions of the objective in meridian and sagittal sections. Figures 3; references: 4 Russian.

6415/9604

**Television Digital-Analog Converter Based on KR1118 PA2A Integrated Circuit**

18600000a Moscow *TEKHNICA KINO I*  
*TELEVIDENIYA* in Russian No 3, Mar 87 pp 33-34

[Article by N.D. Tsykalo, Kirovograd Radio Products Plant]

[Abstract] The article considers the design of a digital-analog converter based on a KR1118 RA2A integrated circuit. A block diagram of the unit, a schematic diagram of the digital part, and the basic technical parameters are presented. The converter has been introduced into production. Figures 2; references: 2 Russian.

6415/9604

**All-Wave Shortwave Receiver Radio-87 VPP**

18600000a Moscow *RADIO* in Russian  
No 3, Mar 87 pp 17-19

[Article by B. Stepanov and G. Shulgin]

[Abstract] This article is the conclusion of one which began in *RADIO*, 1987, No 2, describing in detail the Radio-87 VPP receiver developed in the laboratory of that journal. Figures 6.

6415/9604

**Generator of Random Morse Code Signs**

18600000a Moscow *RADIO* in Russian  
No 3, Mar 87 pp 22-25

[Article by P. Grishin, Leningrad]

[Abstract] A detailed description is given of a generator intended for instruction of radiotelegraph operators and for improvement of their operational skills. The device makes it possible to form letter, digital, and composite nonrepeating texts at a rate continuously adjustable in the limits from 20 to 200 signs a minute. A radio amateur, well informed with respect to operation of the generator, can use a large capacity permanent memory, e.g., the K556RT5 microcircuit. In this case it is possible to enter additional semantic information into the permanent memory: call signs, short additional text. Figures 3.

6415/9604

**Digital Frequency Converter**

18600000a Moscow *RADIO* in Russian  
No 3, Mar 87 pp 47-48

[Article by A. Samoylenko, Novorossiysk]

[Abstract] Ordinarily pulses with stable repetition frequency are formed from the signal of a quartz oscillator with the assistance of a divider which steps down its frequency by a required (most commonly whole) number of times. However, there are frequent cases when, because of the absence of the necessary quartz oscillator, the ratio of the original and required frequencies is not integral, and then one is obliged to use a divider with a fractional scaling factor. It is true that the period of the oscillations formed by it is variable, but in certain instruments this is not important. With the aid of block diagrams the present article describes the principles of operation of a successful variation of the above device. Figures 6; references: 4 Russian.

6415/9604

**Inverse Refraction Problem in Earth's Atmosphere**

18600017b Moscow *RADIOTEKHNIKA I  
ELEKTRONIKA* in Russian Vol 32, No 7, Jul 87  
(manuscript received 13 Dec 85) pp 1367-1373

[Article by V.P. Yakubov and N.A. Simakova]

[Abstract] The possibility of radiowave inspection of the atmosphere of planets (including Earth) leads to interest in the inverse reflection problem allowing a reconstruction of atmospheric layers on the basis of radiowave refraction data. If the source and receiver are not in the atmosphere the inverse problem is soluble by the Able inverse transform. When the receiver is on the Earth's surface, Pavelyev showed that the problem is soluble by means of integral transforms. A new analytic solution of this problem is proposed by reduction to a convolution-type integral solved by direct and inverse Fourier transforms. Examples are given and the solution is applicable for various refraction index profiles. Numerical solution of the proposed integral expression is possible by means of discrete orthogonal transforms with space windows and low-frequency space filtering. An algorithm for numerical solution of the inverse problem is proposed based on the Fourier-Bessel expansion and approximation of the experimental data by an exponential series by means of the least-squares method. References 18: 14 Russian, 4 Western (1 in Russian translation).

12497/9738

**Interaction of Electron Flow and Electromagnetic Field in Multiwave Cherenkov Generator with Power of  $10^{10}$ W**

18600017e Moscow *RADIOTEKHNIKA I  
ELEKTRONIKA* in Russian Vol 32, No 7, Jul 87  
(manuscript received 3 Jul 85) pp 1488-1498

[Article by C.P. Bugayev, V.I. Kanavets, A.I. Klimov, V.I. Koshelev, A.I. Slepov and V.A. Cherepenin]

[Abstract] In order to produce microwave pulses at the kJ energy level, microwave generation with power of at least  $10^{10}$ W is required with pulse lengths exceeding 0.1-1 gms. New types of Cherenkov generators (traveling-wave technology) with large-scale electrodynamic systems are under study for this purpose. In the 3 cm wavelength range maximum power (5 GW at wavelength of 3.2 cm) has previously been produced by a multiwave Cherenkov generator operating in gp-mode with a two-section electrodynamic structure consisting of a diaphragmed waveguide with the same periods. Experimental work was carried out on the Gamma accelerator and was previously described. A high-power electron flow was formed in a coaxial diode with a nonhomogeneous magnetic field. The first waveguide section shows backward and the second section forward traveling-wave interaction. A theoretical and experimental analysis is given of the physical processes in this generator based on matrix analysis and multiport network description of the system conceived in terms of space charge, cyclotron and

synchronous waves. Only the variable longitudinal field structure is taken into account. Determination of the fields and currents in the cells of the periodic structure makes it possible to approximate the directional pattern of the output radiation. Results showed that in a generator with a larger diameter (diameter/wavelength equaling approximately 5), the interaction of the electron flow and the electromagnetic field in gp-mode produced power of 15 GW in the 3 cm wavelength range with efficiency of 50 percent. Interaction effectiveness depends significantly on the intensity of the magnetic field and is determined by the relations of the space charge and cyclotron waves to the electrodynamic field. The radiation has the distinctive directional properties characteristic of traveling-wave antennas. Maximum power is attained at the electrodynamic system's minimum quality factor corresponding to good matching of the electrodynamic structure and the input and output waveguides. Figures 5; references: 7 Russian.

12497/9738

**Application of Kotelnikov's Theorem for Determination of Regularization Conditions for Inverse Refraction Problem**

18600017c Moscow *RADIOTEKHNIKA I  
ELEKTRONIKA* in Russian Vol 32, No 7, Jul 87  
(manuscript received 24 Jan 86) pp 1374-1385

[Article by A.G. Pavelyev]

[Abstract] Radiowave inspection, dispersion interferometer and bistatic radar methods are used for remote probing of the atmosphere of large planets. The radiowave inspection and interferometer methods resemble vertical sounding of the Earth's atmosphere which measures the relation of electron concentration to altitude and establishes the refraction index profile for layers below an ionospheric maximum. The radiowave inspection method gives information only on layers above the critical refraction level. In bistatic radar probing, waves pass through the entire width of the atmosphere and are reflected from the planet's surface and the ray trajectories do not have a turning point which has a determining value for the radiowave inspection method. This creates problems for the solution of the inverse refraction problem which establishes the atmosphere layer profile. Using an integral transform solution for the inverse refraction problem and the Kotelnikov theorem for error evaluation, the reasons are analyzed for the instabilities in the solution of the inverse refraction problem. The spectral frequency interval was determined in which the inverse problem can be solved correctly. Outside of this interval, it is necessary to use a differential method for regularization based on determination of differences between the measured refraction relation and theoretical values leading to correction of the refraction index profile. An example based on data from bistatic radar sensing of Venus' atmosphere is given. If the differences between the experimental data and the theoretical model



are small (but exceed measurement error) useful information can be obtained on atmospheric characteristics. Figures 5; references 23: 20 Russian, 3 Western.

12497/9738

**Characteristics of Two Types of Digital Filters for Linearly Varying Signals**

18600017d Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 32, No 7, Jul 87* (manuscript received 11 Mar 85) pp 1461-1465

[Article by A.Ye. Zhesterev and A.V. Titov]

[Article] A comparative study is made of the characteristics of stationary infinite-impulse characteristic (IIC) filters and finite-impulse characteristic (FIC) filters for signals in the form of a first-order polynomial. Block diagrams are shown for IIC filters while the FIC can be realized by means of parallel Walsh filters. Relations for computing the characteristics are given and graphs of the amplitude-frequency characteristics of the filters are shown. Results of the comparison showed that IIC and FIC, for the same signal parameter deviation estimates, have different amplitude-frequency characteristics while the IIC has a greater dynamic error. For equal error deviations and minimum aggregate errors the IIC had a greater deviation of the speed evaluation and less dynamic error than the FIC. Transfer processes in IIC have greater effective length and when the signal error deviations are equal, this difference between the two filters is significant. Figures 3; references: 4 Russian.

12497/9738

**Quasi-Optics of Axisymmetric Wave Beam Propagating Through Lossless Plane-Laminar Medium: Propagation Along Gradient of Dielectric Permittivity**

18600000b Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 32, No 1, Jan 87* (manuscript received 21 Jan 85) pp 44-53

[Article by N. S. Bukhman and A. L. Gutman]

[Abstract] An axisymmetric Gaussian wave beam propagating through a nonabsorbing plane-laminar medium is considered when reflection occurs within some range of the path with a gradient of dielectric permittivity. Only outside that range does the reflected wave not depend on the incident one, within this range it does so that the boundary conditions can be stipulated only for the incident wave and not for the resultant one. The problem is analyzed on the basis of the corresponding parabolic Helmholtz equation in the approximation of quasi-optics, to which rules of the Wentzel-Kramers-Brillouin approximation regarding circumvention of reversal points are transferable under a not very stringent additional constraint. This approximation is applied to reflection by a half-space with a negative dielectric permittivity, to weak penetration through a

layer with negative dielectric permittivity, and to reflection by a smoothly nonhomogeneous dielectric layer. General expressions are derived for the respective power transmission and reflection coefficients. The authors thank R. L. Yevelson for several helpful suggestions. References: 12 Russian.

02415/09599

**Directional Characteristics of Antennas in Turbulent Medium: Resolution**

18600000b Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 32, No 1, Jan 87* (manuscript received 28 Oct 85) pp 33-43

[Article by A. G. Vinogradov and Z. I. Feyzulin]

[Abstract] The effect of turbulence in the ambient medium on the Rayleigh resolution of a direction finder with a linear receiver antenna is evaluated, using the radiation pattern of the antenna as transfer function. First is calculated the antenna output power upon simultaneous reception of signals from two noncoherent sources located near one another. Calculations are made in the approximation of a phase screen, applicable to an antenna with the characteristic dimension larger than its coherence radius when the turbulent layer dwells within its near-field zone. A correction is added for phase distortions. The shifts of extrema in the radiation pattern, of a principal maximum and of the intermediate minimum between principal maxima, also their dispersions and the dispersion of their difference (relative shift) are then calculated or an antenna with a power-law phase distribution, specifically a 5/3-power phase profile. The mean contrast is calculated from maximum and minimum power of the antenna output signal. Numerical analysis has yielded resulting radiation patterns before and after distortion by turbulence. The corresponding antenna response characteristics indicate an appreciable worsening of the resolution only when the contrast is weaker than in vacuum. The authors thank S. M. Rytov for interest and helpful suggestions, also T. S. Romanova for performing numerical simulations on a computer. Figures 6; tables 1; references 5: 4 Russian, 1 Western (in Russian translation).

02415/09599

**Error of Antenna Radiation Pattern Reconstructed From Discrete Readings of Amplitude-Phase Distribution**

18600000b Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 32, No 1, Jan 87* (manuscript received 26 Mar 85) pp 27-32

[Article by D. G. Asatryan and Dzh. Sh. Khachaturyan]

[Abstract] The relative error of computer-aided reconstruction of the radiation pattern of a linear cophasal antenna from discrete readings of the amplitude-phase

distribution, using the Fourier transformation, is calculated for 10 common amplitude-phase distributions by the method of least squares. The resulting empirical formulas for the error and for the necessary quantization step are to an antenna with a  $D/gl = 50$  diameter-to-wavelength ratio and  $N = 32$  readings of a cosinusoidal field distribution. They are also used for determining the minimum necessary diameter of such an antenna with a uniform field amplitude distribution to ensure that the error of the fifth side lobe will not exceed 30 percent, this diameter being  $D = 7gl$  when the quantization step is  $0.5gl$ . Tables 4; references 10: 9 Russian, 1 Western (in Russian translation).

02415/09599

**Accuracy Characteristics of Superhigh-Resolution Antenna**

18600000b Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 32, No 1, Jan 87 (manuscript received 22 May 85) pp 22-26

[Article by V. V. Karavayev and V. S. Molodtsov]

[Abstract] The performance of the Capon algorithm (PROC. IEEE Vol 57, No 8, 1969) of estimating the power and the coordinates of mutually independent fluctuating point sources is analyzed for accuracy. The errors of such estimates made by a high-resolution antenna are calculated and the ultimate attainable resolution in the Rayleigh sense, namely the difference between corresponding coordinates of two equal-power sources at which a dip still appears in the resultant antenna response, is compared with that attainable in conventional matched processing of the signal field in the antenna aperture. The errors of all estimates, the relative error as far as power estimates are concerned, are found to be inversely proportional to the power of respective sources. The payoff in ultimate resolution is found to be proportional to the fourth root of the source power, the Rayleigh criterion remaining valid at that resolution limit. References: 3 Western (1 in Russian translation).

02415/09599

**Amplitudinal Nonreciprocity of Bragg Diffraction of Light by Traveling Ultrasonic Wave**

18600000b Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 32, No 1, Jan 87 (manuscript received 29 Mar 85) pp 15-21

[Article by P. P. Golokoz and Yu. L. Oboznenko]

[Abstract] Acoustooptic interaction of plane light waves propagating in opposite directions and a traveling ultrasonic wave is analyzed for amplitudinal nonreciprocity of Bragg diffraction, this amplitudinal nonreciprocity being evaluated as the difference of diffraction efficiencies. Divergence of a light wave is assumed to be smaller

than that of an ultrasonic one and amplitudinal nonreciprocity, just as nonreciprocity of velocity changes, is treated as a consequence of different values of the respective mismatch parameters. Numerical calculations reveal that the magnitude of amplitudinal nonreciprocity is determined by the phase modulation index, the ultrasound frequency and divergence angle, and the refractive index of the interaction medium. These results are confirmed by experimental data, measurements having been made using light at the  $gl = 3.39$  gmm wavelength and ultrasound within the  $f = 100$  plus or minus 0.95 MHz frequency band interacting in a medium with a high refractive index. The apparatus consisted on two planoconcave mirrors forming a resonator cavity, an acoustooptic cell inside formed by a Ge single crystal with an absorber and with an ultrasonic transducer excited by an external high-frequency oscillator, and between that cell and each resonator mirror a vessel with a He-Ne mixture as amplifying medium. Measurements were made with two photoreceivers, one on each side of the acoustooptic cell and both feeding output signals to a recording instrument through a differential amplifier. Figures 5; references 5: 4 Russian, 1 Western.

02415/09599

**Experimental Study in Search of Mechanism Responsible for Shaping Field of Millimetric Waves During Their Propagation Above Sea Surface**

18600044b Gorkiy *IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA* in Russian Vol 30, No 8, Aug 87 (manuscript received 5 Dec 85, after revision 5 Sep 87) pp 947-950

[Article by L. M. Lobkova, Yu. P. Mikhaylyuk, N. I. Mishareva, and V. V. Stelmakh, Sevastopol Institute of Instrument Design]

[Abstract] An experimental study was made concerning propagation of millimetric waves, specifically waves within the 2 mm band, above the sea surface. The year-round study lasting from July 1982 to July 1983 involved recording amplitude fluctuations of signals at the receiver input and placing the receiver at various distances (3.5, 7.2, 9.6 km) from the transmitter, for the purpose of determining the dependence of these fluctuations on the channel length as well as on the meteorological conditions ranging from smooth sea surface in the Rayleigh sense to rough sea with its waves rising up to 0.5 m. Electromagnetic waves were transmitted with linear polarization, the design of both directional transmitter and receiver antennas with 7.5 mrad wide major lobes and with polarization filters in their feeder circuits ensuring adequate suppression of quadrature polarization by at least 30 dB. An analysis of the data on the basis of the Rayleigh-Rice model and an empirical parameter, namely ratio of the average signal envelope to the r.m.s. signal amplitude fluctuation, reveals the relative contributions of a direct tropospheric wave and a "maritime" wave reflected by the sea surface to the resultant field at

the receiver point. Dominance of either wave, the "maritime" wave having a specularly reflected component and a diffusely reflected one, is found to depend also on the orientation of the major axis in the radiation pattern of the receiver antenna relative to the direction from receiver to transmitter. In the case of alignment both tropospheric and "maritime" wave appear in balance, while the tropospheric wave becomes dominant when the receiver antenna is lifted by as much as 5 mrad and the "maritime" wave becomes dominant when the receiver antenna is dipped: the specular component of the "maritime" wave when the receiver antenna is dipped by as much as 5 mrad and the diffuse component of the "maritime" wave when the receiver antenna is dipped further through 10 mrad to 20 mrad. These differences become less pronounced with increasing distance from receiver to transmitter and eventually the patterns begin to overlap. Figures 6; references 4: all Russian.

02415/09599

**Determination of Altitudinal Profiles of Atmospheric Refractive Index Over Optical and Microwave Ranges of Radiation Spectrum From Measurement of Thermal Radio Emission**

18600044c Gorkiy IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 30, No 8, Aug 87 (manuscript received 14 Nov 85) pp 951-960

[Article by N. N. Markina, Ap. P. Naumov, and M. I. Sumin]

[Abstract] The method of determining altitudinal profiles of the refractive index in the terrestrial atmosphere from readings of meteorological characteristics obtained by probing from the ground, specifically from readings of the thermal radio emission measured at wavelengths within absorption resonance in O<sub>2</sub> (5 mm wavelength) and H<sub>2</sub>O (1.64 mm and 1.35 cm wavelengths), is evaluated for accuracy on the basis of experimental data and semiempirical relations covering both optical and microwave ranges of the refraction spectrum. The refractive index is a function of both temperature and pressure, pressure of dry air and partial pressure of water vapor having to be treated separately for refraction of microwave radiation but lumping them together into total atmospheric pressure being allowed for refraction of optical radiation. Expressions for the r.m.s. errors of such a determination of the refractive index are derived, taking into account that both temperature and humidity of the atmosphere depend on the pressure and with the partial pressure of water vapor accordingly expressed through total pressure and humidity. The correlation coefficients in the regression equation are found to vary depending on the season in which measurements have been made, the difference being largest between summer and winter. In estimating the accuracy of altitudinal index profiles constructed from the results of radio-thermal probing is also taken into account the effect of

cumulus, cumulonimbus, and strato-nimbus clouds present in the atmosphere. Figures 1; tables 3; references 42: 23 Russian, 1 Hungarian, 18 Western (1 in Russian translation).

02415/09599

**Experimental Study of Antenna Systems in Time Domain**

18600044d Gorkiy IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 30, No 8, Aug 87 (manuscript received 15 Sep 85, in final version 11 Mar 87) pp 1,023-1,029

[Article by D. M. Ponomarev, A. V. Goryachev, V. N. Khavronkov, and S. V. Goryunova, Gorkiy Polytechnic Institute]

[Abstract] Performance analysis of open systems such as antenna arrays by the pulse-time method is becoming desirable owing to availability of ultrashort test signals and computer capacity for Fourier processing, complexity of computer hardware and software being more than offset by simplicity of test equipment. The principle is demonstrated on determination of the transient characteristics of antenna arrays receiving electromagnetic pulse signals from a source in the far-field region and operating within the linear range. Experiments were performed with equipment consisting of an oscillator with a TEM transmitter antenna, a standard receiver antenna alongside the tested one, and a stroboscopic oscillograph synchronized with the oscillator and feeding data from the two receiver antennas to a computer through separate channels. Probing pulses with a shorter than 70 ps rise time from the oscillator were used for testing a horn antenna next to a reflecting metal shield, a 600 MHz rod antenna on a conducting disk, and a 0.6-1.2 GHz helical antenna with nonuniform pitch. Useful signals were extracted by space-time discrimination. The pulse response characteristics and the directional characteristics were determined in this way, all three test antennas having been specially designed for easy theoretical verification of the results. Figures 9; references 7: 3 Russian, 4 Western (3 in Russian translation).

02415/09599

**Attainment of Maximum Sensitivity in Modulation-Type Microwave Radiometers**

18600044a Gorkiy IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 30, No 8, Aug 87 (manuscript received 12 Jul 85, after completion 29 Jan 87) pp 931-938

[Article by N. N. Vorsin, Yu. A. Militskiy, V. M. Shainskiy, and V. S. Etkin, Institute of Space Research, USSR Academy of Sciences]

[Abstract] With the sensitivity of a radiometer defined as the r.m.s. value of output signal fluctuations referred to the input signal and expressed in degrees of noise temperature, a modulation-type microwave radiometer is

evaluated for design and performance optimization. The evaluation, based on general relations applicable to a radiometer with noise compensation, reveals that receiver instability is the principal factor which lowers the radiometer sensitivity. Maximum sensitivity of an ideal radiometer with stable receiver is attained by compensation with a signal from an external constant-current source. For a modulation-type radiometer the compensating signal is generated by passing a reference noise signal from a conventionally matched load through the receiver. In this case the sensitivity can be improved by lengthening the storage time for the compensating signal relative to the storage time for the useful signal. Another method is dividing the output signal from the measurement channel by the reference-channel signal, the latter being at any instant of time proportional to the ratio of the constant component of the receiver output signal to the noise temperature of the receiver input signal plus intrinsic receiver noise. A comparative evaluation of a radiometer with one, two, and several receivers indicates that the maximum possible sensitivity is approached by increasing the number of receivers and thus compensating poor stability of any among them. Figures 4; references 5: 3 Russian, 2 Western.

02415/09599

UDC 621.391.272

**Acoustooptical Time Compression of Binary Pulse Sequences**

18600043f Moscow *RADIOTEKHNIKA* in Russian  
No 9 (manuscript received after completion 6 Feb 87)  
pp 67-69

[Article by V.L. Baikin, L.N. Preslennov, and V.O. Solovyev]

[Abstract] The feasibility of compressing binary pulse sequences in time by means of an acoustooptic space-time modulator and a multitap fiber-optic delay line has been established on the basis of theoretical and experimental evaluation. The compressor apparatus includes a pulsed laser with a beam collimator on the input side, a radio-frequency signal generator coordinated with the modulator, a two-lens telescope and a photoreceiver coupled through the fiber-optic delay line on the output side. The modulator aperture, equal to the product of acoustic-signal velocity and maximum signal delay time in the modulator, must be not smaller than that velocity multiplied by the duration of one pulse and the number of pulses in the sequence. The experiment was performed with a 32DL105 semiconductor laser, a collimator consisting of two cylindrical lenses, a piezo-ceramic modulator on a  $\text{TeO}_2$  single crystal operating in the "slow" 600 m/s acoustic shear mode, and a multimode optical fiber having a 0.91 numeric aperture and a 0.050 mm core diameter. A compression ratio of  $10^2$ - $10^3$  was found to be attainable. figures 3; references 7: 2 Russian, 5 Western (1 in Russian translation).

2415/12232

UDC 537.874.2

**Amplitude-Frequency and Phase-Frequency Characteristics of Radio Waves Reflected by Ionosphere**

18600043e Moscow *RADIOTEKHNIKA* in Russian  
No 9, Sep 87 (manuscript received 29 Oct 86) pp 61-63

[Article by V.Ye. Kunitsyn, V.A. Smorodinov, and A.B. Usayev]

[Abstract] Reflection of radio waves by an ionospheric layer is considered and an algorithm is proposed for calculation of the complex reflection coefficient, including the frequency characteristics of its amplitude and phase, applicable to any kind of ionospheric layer and when the approximation of geometrical optics is not. The algorithm is based on the conventional model of scalar waves and an isotropic ionosphere, according to which the electric field of radio wave satisfies the corresponding Helmholtz equation. For the more general case of oblique incidence, space is subdivided into three regions and the electric field in each is found as the analytical solution to that equation: free space between radio transmitter-receiver and lower ionosphere boundary, region with nonzero electron concentration, free space above upper ionosphere boundary. The equation is then reduced to a Riccati equation, by introduction of a new variable, where-upon the boundary condition at the upper ionosphere boundary is reduced to zero value and the equation is solved by a numerical method such as prediction and correction. High efficiency and accuracy of this algorithm are demonstrated on calculations for a plane-parallel ionospheric layer. Figures 2; references 8: 5 Russian, 3 Western (1 in Russian translation).

2415/12232

UDC 621.396.67

**Protection of Useful Signal by O.L. Frost Method Against Errors in Adaptive Antenna Array**

18600043c Moscow *RADIOTEKHNIKA* in Russian  
No 9, Sep 87 (manuscript received 15 Apr 87) pp 47-52

[Article by A.A. Pistolkors, corresponding member, USSR Academy of Sciences]

[Abstract] An adaptive antenna array with limited suppression in the direction of the major-lobe peak, according to the O.L. Frost algorithm, is considered for operation with protection of a useful signal arriving at any angle on the basis of the minimum-noise criterion. Such an array, a linear one consisting of  $N$  nondirectional radiators spaced uniformly a half-wavelength apart, is evaluated for sensitivity to two kinds of structural errors. An error of radiator location causes phase deviation which varies depending on the directional of signal

incidence. Nonidentity of radiators causes differences of voltage amplitudes at the summator inputs, these amplitudes not depending on the direction of signal incidence. Analysis and calculations reveal that this adaptation algorithm completely eliminates the effect of radiator location error, while with nonidentical radiators yields the same maximum output signal-to-noise ratio as with an array consisting of the same number of nondirectional radiators corrected all to their average equivalent height. This algorithm is, therefore, more expedient than the "generalized sidelobe canceler" algorithm according to L.I. Griffiths. Figures 2; references 7: 1 Russian, 6 Western.

2415/12232

UDC 621.396.965.8:681.325.5

**Radio Altimeter with Microprocessor Operating in Pulse Mode**

18600043g Moscow *RADIOTEKHNIKA* in Russian  
No 9, Sep 87 (manuscript received after completion  
20 Feb 87) pp 70-71

[Article by V.B. Pestryakov and V.V. Yarmola]

[Abstract] A radio altimeter operating in the pulse mode, as a digital instrument, is proposed with complete microprocessor-computer hardware and software ensuring high accuracy without prohibitively intricate digital circuitry beyond an analog-to-digital converter. The microprocessor-computer module is segmented, for higher speed, and includes an extra buffer memory which makes the length of discrimination time independent of the data input time. A discrimination time of 20-25 ns ensures an accuracy within 5-20 ns with probing pulses of not shorter than 40-50 ns duration. An algorithm of linear interpolation included in the software makes the instrument a tracking one. The anal-to-digital converter and the buffer memory can be build with respectively series K1107 and Series K500 integrated-circuit chips. Figures 1; references 6: 4 Russian, 2 Western (1 in Russian translation).

2415/12232

UDC 621.391.821:621.396.550.388.2

**Estimating Statistical Characteristics of Signals Submerged in Atmospheric Radio Interference**

18600043c Moscow *RADIOTEKHNIKA* in Russian  
No 9, Sep 87 (manuscript received, after completion,  
3 Mar 87) pp 44-46

[Article by V.V. Kabanov]

[Abstract] A method of estimating the statistical characteristics of signals submerged in atmospheric radio interference with unknown characteristics is outlined, a method which utilizes the nonparametric property of characteristic functions. The interference is assumed to

consist of a pulse component and a fluctuation component, both evolving from a Poisson-Poisson flux of atmospheric statics. The signal, with a fluctuating amplitude, has an envelope describable as a Nakagami m-distribution and reducible to a normal process. The characteristic function of each is tested for two alternative hypotheses, namely for having or not having zeros. In the former case estimating their location facilitates verification of statistical hypothesis, determination of the statistical characteristics of the signal from the parameters of its characteristic function. The characteristic function of the signal plus interference mixture can, moreover, be factorized on the basis of the properties of its estimate. Figures 1; references 6: all Russian.

2415/12232

UDC 621.391.82

**Action of Ensemble of Interference Signals on Receiver**

18600043b Moscow *RADIOTEKHNIKA* in Russian  
No 9, Sep 87 (manuscript received after completion  
19 Dec 86) pp 13-15

[Article by L.Sh. Alter]

[Abstract] Performance of a radio receiver operating within the range of many transmitters is treated as a problem of electromagnetic compatibility and is evaluated from the standpoint of receiver selectivity relative to interference signals outside the operating frequency band. Analysis and calculation of the frequency selectivity, for a receiver of FM signals operating above the threshold level, reveal that the signal-to-interference ratio at the receiver output and the interference components at the demodulator input depend on the receiver parameters which determine its sensitivity as well as on the amplitudes and the frequency separations of interference signals. References 12: all Russian.

2415/12232

UDC 621.396,96

**Maximum-Likelihood Estimation of Coordinates of Signal Source During Multi-Positional Direction Finding**

18600043 Moscow *RADIOTEKHNIKA* in Russian  
No 9, Sep 87 pp 9-10 [Annotation of article No 1117-sv  
deposited at Central Scientific And Technical Institute  
'Informasvyaz']

[Article by A.V. Rabtsun]

[Abstract] An iterative algorithm of secondary data processing which yields maximum-likelihood estimates of the space coordinates of a signal source is proposed for a multipositional direction finding system, this algorithm being preferable to nonoptimum conventional heuristic ones. It is based on measurements made at an

arbitrary number of different points with known space coordinates and on the probability density of sample values for independent normal distributions of unbiased azimuth and elevation estimates. Such a maximum-likelihood estimate is shown to be equal to the least-squares estimate when the latter has been obtained from readings at points equidistant to the signal source and to be otherwise more accurate. Analysis of this algorithm by statistical simulation has demonstrated its high efficiency when the errors of azimuth and elevation angles do not exceed 30 deg. Figures 1; referenced 4: all Russian.

2415/12232

**Two-Channel Infrared Radiometer for Investigation of Characteristics of Natural Background Disturbances**

18600000b Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY:

PRIBOROSTROYENIYE in Russian

Vol 30, No 3, Mar 87 (manuscript received 10 Jun 86)  
pp 72-78

[Article by V.A. Firago and B.Yu. Khanokh, Belorussian State University imeni V.I. Lenin]

[Abstract] The article considers results of the development of a two-channel scanning infrared radiometer intended for investigation of the statistical characteristics of the spatial fluctuations of the radiation of a natural background. The radiometer operates on the compensating principle, the basic parameters and methods of calibration of which were selected in terms of certain a priori data on the properties of the backgrounds under investigation and the methods of determining their principal statistical characteristics. The article is recommended by the Department for Quantum Radiophysics and Optoelectronics. Figures 1; references 6: 5 Russian, 1 Western.

6415/9604

**Investigation of Characteristics of Electron-Optical Transducer in Pulse Mode**

18600000b Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY:

PRIBOROSTROYENIYE in Russian

Vol 30, No 3, Mar 87 (manuscript received 27 May 86)  
pp 81-84

[Article by S.S. Romanov and S.M. Gvozdev, Moscow Power Engineering Institute]

[Abstract] The article presents the results of investigations on the resolution, amplitude-frequency, and frequency-contrast characteristics of the receiving part of a system of visualization in the nanosecond range of operation of a shutter. The investigations conducted are closely linked with a real operating regime of active-pulse systems of visualization, which makes it possible to use the experimental results to optimize the parameters

of visualization systems, as well as for calculation of visibility during their use. The article is recommended by the Kafedra of Illumination Engineering. Figures 3; references: 9 Russian.

6415/9604

**Effect of Nonuniformity of Sound Intensity Distribution on Efficiency of Acoustic-Optical Interaction**

18600223c Moscow RADIOTEKHNIKA I

ELEKTRONIKA in Russian Vol 32, No 4, Apr 87

(manuscript received 4 Apr 85) pp 696-702

[Article by V.N. Mikhaylov and V.M. Musin]

[Abstract] The article demonstrates that the basic reason for the impossibility of achieving 100 percent efficiency of diffraction at the expense of an increase of the light intensity with respect to a section of the light beam is that during interaction there is nonuniformity of the sound intensity distribution on the light beam section. The solution of the equations for the amplitudes of the sound and light waves, obtained in an approximation of the small deflection from the uniformity of the distribution, makes it possible to establish conditions, during which the maximum efficiency of diffraction is realized. A numerical integration is conducted for the initial equations, the results of which agree with analytical formulas for all actually attainable values of the parameters. The numerical solution is also used for improvement of the field of applicability of other previously published approximate solutions, which describe the acoustic-optical interaction. Figures 2; references: 7 Russian.

6415/12232

**Characteristics of Antenna Directivity with Optimum Discrimination of Space-Time Signals**

18600223h Moscow RADIOTEKHNIKA I

ELEKTRONIKA in Russian Vol 32, No 4, Apr 87

(manuscript received 12 Nov 85) pp 885-887

[Article by D.D. Kloviskiy and A.Yu. Sherman]

[Abstract] The article is concerned with 1) the characteristics of antenna directivity with optimum discrimination of vector fields; and 2) the optimum characteristics of the directivity of an antenna for a single-beam model of a signal. References 8: 7 Russian, 1 Western.

6415/12232

**Fluctuations in the Layer Near to the Ground of Optical Beams of Different Diameters**

18600223g Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian* Vol 32, No 4, Apr 87 (manuscript received 20 May 85) pp 874-876

[Article by T.I. Arsenyan and G.I. Zandianova]

[Abstract] In order to study the effect of the size of a beam on the statistical characteristics of optical radiation under the conditions of a large city, an experimental analysis was made of the fluctuations in the intensity of laser radiation on a horizontal route. The route was arranged at a height of 25 meters from the surface of the earth. The distance between the transmitter and the reflector was 350 meters. A generator of coherent optical radiation with a wave length  $\lambda = 0.63$  micrometer, operating in a single-mode regime was employed as a transmitter. Use of a collimating device and a changeable diaphragm with a diameter from 3 to 7 mm made it possible to obtain a collimated beam with a Fresnel number at the input to the atmosphere of  $gQ = kR^2/L$ , varying in the limits from 0.18 to 35. Here  $k = 2\pi/\lambda$ .  $R$  is the effective radius of the beam.  $L$  is the length of the route. Designs with a knife diaphragm and with amplitude grating were used. A Type FEU-22 photomultiplier was used, from the output of which the signal advanced to amplitude input, which accomplished direct amplification of the signal at the modulation frequency in the 0-500 Hz band. From the output of the amplifier, the voltage entered a N-110 recorder. At the time of the measurements, control was conducted of the constancy of the radiated power and an analysis was made of the values near to the ground of the parameters of the atmosphere, using data from the Moscow University meteorological observatory located close to the route. Figures 2; references: 5 Russian.

6415/12232

**Electromagnetic Wave Scattering by Non-Equidistant Grating Consisting of a Finite Number of Oblique Strips**

18600223b Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian* Vol 32, No 4, Apr 87 (manuscript received 2 Dec 85) pp 687-695

[Article by S.N. Vorobyev]

[Abstract] Using the spectral method and inversion of an integral operator, a strict solution is obtained for the problem of scattering of electromagnetic waves at a non-equidistant grating consisting of a finite number of oblique strips. An effective algorithm was produced for a numerical solution of the problem. An evaluation of the number of elements was made. The effect of a disturbance of the periodic structure on the characteristics of an scattered field was investigated.

The author thanks S.L. Prosvirnin for constant interest in the work and helpful discussions of its results. Figures 5; references: 4 Russian.

6415/12232

**Retrieval of Profile of Refractive Index of Troposphere According to Measurements of the Frequency of Signals of a Satellite**

18600223a Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian* Vol 32, No 4, Apr 87 (manuscript received 10 Oct 85) pp 673-680

[Article by N.A. Armand, V.A. Andrianov, and V.M. Smirnov]

[Abstract] On the basis of an A.N. Tikhonov method of regularization for a one-dimensional spherically-layered model, the inverse problem of the radio transparency of the terrestrial troposphere on an earth satellite path is theoretically and experimentally solved. Numerical modelling was performed for conditions of normal and anomalous wave propagation. Evaluations were obtained of the potential accuracy of a proposed algorithm. The algorithm was used for numerical determination of real high-level profiles of the refractive index of the troposphere according to measurements of the Doppler shift of the frequency of the radio signals of the satellite and was shown to be effective. Figures 3; references: 10 Russian.

6415/12232

**Factors Which Have an Effect on Atmospheric Dielectric Constant-Experimental Investigations**

18600212g Moscow *ELEKTROSVYAZ in Russian* No 4, Apr 87 (manuscript received after revision 1 Dec 86) pp 50-53

[Article by Ts.I. Tsanev and S.V. Voynov, People's Republic of Bulgaria]

[Abstract] The article considers methods for conducting experiments and the experimental results obtained in determining the effect of the parameters of the atmosphere and the frequency of a high-frequency field on the origin of spontaneous flare discharges. The following are considered in detail: 1) Experimental conditions; 2) Frequency dependence; 3) Effect of parameters of modulation signal; 4) Dependence of atmosphere parameters—pressure, temperature, humidity; 5) Effect of mechanical particles; and 6) Effect of cosmic rays. Figures 3; references 10: 8 Russian, 2 Western.

6415/12232

**Use of Concerning Multiwire Feeders for  
Transmission Shortwave Antennas**

18600212f Moscow *ELEKTROSVYAZ* in Russian  
No 4, Apr 87 (manuscript received 31 Mar 86) pp 45-50

[Article by V.I. Komissarov]

[Abstract] The possibility is considered of using a concentric multiwire feeder for transmission short-wave antennas, and its operation are analyzed using various

circuit diagrams of a shielded conductor as related to the earth. Features of operation of short-wave feeders and theoretical analysis are considered in detail. Figures 11; References 5: 4 Russian.

6415/12232



UDC 621.382.2.029.64

**Dependence of Energy Characteristics of Short Gunn-Effect Diodes on Voltage Waveform**

18600046e Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 32, No 9, Sep 87 (manuscript received 5 Nov 85) pp 1947-1954

[Article by Yu.V. Arkusha, A.A. Drogachenko, and E.D. Prokhorov]

[Abstract] Performance characteristics of millimetric-wave short Gunn-effect diodes with an approximately 0.0025 mm long interaction space are calculated on the basis of the one-dimensional two-temperature model, this model being not only applicable to large electron concentration and electric field gradients but also allowing inertia effect to be taken into account. The system of equations of this model is obtained from the Boltzmann equation of kinetics by averaging it over concentration, momentum, and energy. Its equations are those of continuity, current, and energy conservation in each of the two valleys, supplemented by the Poisson equation, with coefficients representing reciprocals of concentration relaxation time and energy relaxation time. Each relaxation time includes effects of scattering by acoustic phonons, by polar and nonpolar optic phonons, also by ionized impurities, as well as of intervalley and equivalent intervalley scattering. The system of equations without the Poisson equation yields a parabolic equation for the rate of change of voltage. The latter is solved by reduction of a second-order difference equation to three first-order ones, omitting either left-hand or right-hand elimination. It has been solved numerically for a typical GaAs device with upper and lower valleys. The efficiency-frequency characteristic of diodes with dipole domain and of diodes with charged layer have been subsequently calculated, assuming a supply voltage with a fundamental-frequency sine ripple and a second-harmonic cosine ripple. The second-harmonic ripple is found to increase the fundamental-harmonic efficiency of a diode oscillator without affecting its bandwidth. A diode with charged layer is found to have a larger bandwidth but a lower efficiency than a diode with dipole domain. Figures 4; references 8: 7 Russian, 1 Western.

2415/12913

UDC 621.391.01

**Receiver for Detection of Nongaussian Signals**

18600046f Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 32, No 9, Sep 87 (manuscript received 8 Jan 86) pp 1981-1983

[Article by V.A. Kochetov and A.M. Sizmin]

[Abstract] A receiver with two spaced antennas operating on the basis of the fourth-order joint cumulant function is considered for detecting and ranging

sources of non-Gaussian signals in the presence of stationary Gaussian interference. Coergodic two intrinsic receiver noises or an additive mixture of both and correlational noise interference are assumed to appear in the absence of a useful signal. A useful signal is assumed to appear in an additive mixture with Gaussian noise and interference signals. The two receiver channels have each a bandpass filter, the filter in one followed by a delay line, and a common sine-cosine resolver at their inputs. They combine into one channel executing the detection algorithm and containing two arrays of four multipliers, one pair of multipliers followed by a third one, one single multiplier, one array of four low-pass filters, one array of four squarers, one single squarer, two arrays of four integrators, one pair of integrators, one single intermediate summator, one pair of intermediate summators, five scaling amplifiers, and one output summator which feeds a threshold device. Both correct-detection probability and false-alarm probability with such a receiver have been calculated as functions of the composite signal-to-noise ratio. The output function for correlated Gaussian interference is found to have a larger dispersion than that for correlated Gaussian noise. The normalized output function for signals with phase modulation has a minimum, the same as that for a harmonic signal. Figures 2; references 2: 1 Russian, 1 Western.

2415/12913

UDC 537.312.62:621.3.029.64

**Optimization of Coupling Between Superconducting Thin-Film Interferometers and Dielectric Resonator**

18600046d Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 32, No 9, Sep 87 (manuscript received 16 Aug 85) pp 1938-1946

[Article by N.A. Simonov]

[Abstract] The design and performance analysis of superconducting thin-film ring interferometers with dielectric resonator, for parametric amplifiers or microwave SQUIDs, reveals that maximum efficiency requires a maximum coefficient of inductive coupling between ring and resonator. This coefficient is calculated on the basis of the field distribution in square slab of a material with a high dielectric permittivity, considering first such a resonator coupled to a small ring and then one coupled to a large wide ring. The results are extended for a two-dimensional array of ring interferometers and then for such an array connected to a common superconducting auto-transformer whose core dimensions are comparable with those of the resonator slab, calculations in the latter case being made with use of the equivalent

circuit diagram. The author thanks K.K. Likharev and L.S. Kuzmin for formulating the problem and discussing the results. Figures 5; references 8: 4 Russian, 4 Western.

2415/12913

UDC 681.7.069.32.001

**Analytical Method of Calculating Integral Characteristics of Electron-Optical Emission Systems**

18600046c Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 32, No 9, Sep 87* (manuscript received 12 Dec 85) pp 1922-1929

[Article by Ye.A. Dynin]

[Abstract] Integral characteristics of an electron-optical emitter array, specifically its frequency-contrast characteristic, are calculated by the analytical method of transfer functions. The transfer functions are two-dimensional Fourier transforms of the scattering-point function, delta singularity function, with respect to emitter-to-image trajectories and to velocity distribution over the cathode surface. They are determined on the basis of a multiparametric model which includes the Heaviside step function and a set of coefficients, these coefficients representing normalized experimental data on the energy spectrum of emitted electrons and characterizing a Maxwell spectrum in the case of devices with axisymmetric electrostatic lenses. The transfer functions yield the mean radius of the scattering spot into which a point has been expanded by magnification, defocusing, and spherochromatic aberration. Minimization of this radius with only spherochromatic aberration retained and with the velocity of electrons having maximum initial energy held constant yields then the frequency-contrast characteristic. Geometrical aberrations, ideally absent, are taken into account in terms of the coma parameter. Figures 1; references 22: 17 Russian, 5 Western (1 in Russian translation).

2415/12913

UDC 537.874.6.01

**Asymptotic Expressions for Elementary Boundary Wave**

18600046b Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 32, No 9, Sep 87* (manuscript received 25 Apr 85, after correction 2 Jun 86) pp 1818-1828

[Article by D.I. Butorin, N.A. Martynov, and P.Ya. Ufimtsev]

[Abstract] Scattering of an electromagnetic wave by the edge of an ideally conducting wedge is analyzed, the scattered field consisting of a uniform reflection

component and a nonuniform diffraction component generated by the surface current each. On the basis of applicable current and potential relations, with the wedge faces treated as arrays of infinitesimally narrow elementary strips for an analytical description of the diffraction pattern, asymptotic expressions are obtained for the field of an elementary boundary wave scattered by one such pair of strips. These expressions describe the radiation pattern and yield two cones within which the diffraction component propagates. They also reveal a shielding effect, both faces of the wedge shielding the inside region, and a noncompliance with the duality principle in the general case. As a separate problem of practical interest is considered that of an edge curving along a circular arc, specifically a disk, and scattering a plane wave. Figures 3; references 5: 4 Russian, 1 Western.

2415/12913

UDC 621.396.96.01

**Probabilistic Models of Non-Rayleigh Fluctuations of Radar Signals: Review**

18600046a Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 32, No 9, Sep 87* (manuscript received 21 Nov 85) pp 1793-1817

[Article by V.M. Shlyakhin]

[Abstract] The results of research into the statistical characteristics of narrow-band useful radar signals arriving at the receiver antenna after reflection by targets of various kinds are systematically reviewed, on the basis of theoretical and experimental studies made in the USSR and worldwide during the 1963-85 period. A table lists known possible distributions of non-Rayleigh signal amplitude fluctuations: 12 biparametric ones, 6 triparametric ones, and 7 multiparametric ones. The analytical model and the probability density curve of each distribution are shown, also initial moments as well as characteristic functions of signal and envelope where applicable and available. Physical justification and interpretation of each mode are included in the text. Tables 1; references 48: 27 Russian, 21 Western (3 in Russian translation).

2415/12913

**Relative Sensitivity of Optimum Digital Fiber-Optic Communication Systems**

18600045a Kiev *IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 30, No 9, Sep 87* (manuscript received, after revision, 29 Sep 86) pp 3-7

[Article by V. I. Makkaveyev and N. N. Petrova]

[Abstract] Length of the relaying line, a function of several structural parameters, is selected as the optimality criterion for optimal design of digital fiber-optic communication systems. Its relative sensitivity

to variation of the optimum parameters which maximize it is calculated for a graded-index multimode fiber-optic line according to the relation  $E_p e^{-\alpha L} = E_r$  ( $E_p$  - energy of radiation pulse at entrance to line,  $\alpha$  - attenuation coefficient,  $L$  - length of line,  $E_r$  - energy of radiation pulse at exit from line). It thus depends essentially on the attenuation coefficient and the pulse duration. The attenuation coefficient has a Rayleigh-scattering component inversely proportional to the fourth power of the radiation wavelength and a loss-at-microcorners component proportional to an  $s$ -th power of the core radius as well as to the  $(s$  plus 1)-th power of the difference between the refractive indexes of the core material and the sheath material. The pulse duration at the photoreceiver, at the exit from the line, is equal to the square root of the sum of input pulse duration squared plus pulse widening due to dispersion by intermodulation squared. Numerical calculations for design and performance analysis are made for such a line operating at either 850 nm or 1300 nm wavelength. Figures 5; references 5: 1 Russian, 4 Western (1 in Russian translation).

02415/09599

#### Stability Characteristics of Robust Decision Rules for Signal Detection

18600045c Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 30, No 9, Sep 87 (manuscript received,  
after revision, 11 Aug 86) pp 12-15

[Article by V. Ya. Litnovskiy]

[Abstract] The problem of detecting a signal in the presence of variable-statistics interference is considered, and a measure of robustness as criterion is proposed for comparing different detection procedures with different decision rules. This measure combines efficiency and stability, an increase of one costing a decrease of the other. Following a formulation of the two signal absence and signal presence hypotheses, it is applied to two noncoherent detection procedures: one involving a test which is optimum for the apriori given respective two sample distribution densities and one involving quantization of two finite-dimensional samples for a likelihood-sum signal absence hypothesis and a likelihood-ratio signal presence hypothesis. The robustness of the two corresponding decision rules is evaluated for detection of a constant signal at the output of a square-law detector. Their stability is found to depend weakly on the signal level and on the parameters of the interference distribution, which ranks them as intermediate between nonparametric and classical ones. Figures 3; references 4: 2 Russian, 2 Western (1 in Russian translation).

02415/09599

#### Distortions of Compound Signals in Radar Frequency Converters Due to Heterodyne Voltage Instability

18600045j Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 30, No 9, Sep 87 (manuscript received,  
after revision, 13 Aug 86) pp 83-85

[Article by V. V. Gazhiyenko and V. A. Drapiy]

[Abstract] Distortions of a compound microwave signal by modulating interference in the frequency converter of a coherent radar are analyzed, these distortions being determined by the indeterminacy function of the signal. Levels of both signal and interference components of that function are calculated, their dependence on the heterodyne voltage instability being established as a result on the basis of circuit and performance analysis applicable to IMPATT-diode and TE-diode oscillators. Figures 2; references 4: 3 Russian, 1 Western (in Russian translation).

02415/09599

#### Improving Resolution of Radar With Synthesized Aperture

18600045i Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 30, No 9, Sep 87 (manuscript received,  
after revision, 27 Jan 86) pp 80-83

[Article by L. G. Dorosinskiy]

[Abstract] A radar with synthesized aperture processing a signal from a distributed target is considered, in which case the maximum-likelihood algorithm of processing is too impractical, and the optimum algorithm is constructed which yields the maximum logarithm of the probability density vector over the set of apriori admissible combinations of target coordinates and power densities. The number of statistically independent vectors in the input data is determined by the number of frequency channels in the case of a wide-band or multifrequency signal, or by the number of segments in the piecewise-coherent signal trajectory. The resolution of the optimum algorithm approaches asymptotically the one estimated on the basis of the Kramer-Rao inequality, for synthesis of the target image by construction of the Bartlett radiation pattern representing the spectrum of space frequencies. A better resolution is attainable by the high-resolution method or the maximum-entropy method, as has been confirmed by statistical simulation experiments. Figures 2; references 5: 2 Russian, 3 Western.

02415/09599

**Analysis of Vibrational Overloads and Evaluation of Strength Margin During Design of Radioelectronic Equipment**

18600045g Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 30, No 9, Sep 87 (manuscript received, after revision, 8 Oct 86) pp 59-62

[Article by A. M. Tartakovskiy and Ye. N. Makvetsov]

[Abstract] One aspect of designing radioelectronic equipment is considered, namely ensuring adequate vibration resistance. The dynamic characteristics of a structural model are analyzed on the basis of the standard second-order differential equation in the generalized displacement vector, with stiffness, damping, inertia terms in matrix form on the left-hand side and vector of external action on the right-hand side. The corresponding eigenvalue problem is solved for resonances, assuming a negligible shift of resonance frequencies caused by viscous friction. Subsequent calculations involve essentially the energy balance and are aimed at determining the strength margin during resonances, under worst-condition overloads. The procedure, with the differential equation of elasticity reduced to a difference-differential one, is demonstrated on the simple case of longitudinal vibrations of a beam fixed at both ends. Figures 1; references 3: 2 Russian, 1 Western (in Russian translation).

02415/09599

**Multifrequency Mode of Receiver With Mixer Operation**

18600045h Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 30, No 9, Sep 87 (manuscript received, after revision, 23 Jul 86) pp 79-80

[Article by V. P. Potiyenko and T. N. Narytnik]

[Abstract] Performance characteristics, namely output power and noise factor, of a receiver with mixer in an instrument measuring thermal radio emission by objects are calculated with load losses as well as mixer losses taken into account. It is shown theoretically that frequency compression of the radiation power from the object's high-frequency emission band into the much narrower passband of the receiver's linear part will appreciably improve the instrument sensitivity, but the practical feasibility of such a scheme is yet to be established. Figures 1; references 3: 2 Russian, 1 Western.

02415/09599

**Estimation of Fresnel Fluctuation Level in Response of Acoustoelectronic Fourier Converter**

18600045f Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 30, No 9, Sep 87 (manuscript received, after revision, 19 Sep 86) pp 55-57

[Article by A. Yu. Mikhatskiy]

[Abstract] The response of an acoustoelectronic Fourier converter to a linearly frequency-modulated input signal is analyzed for Fresnel fluctuations during the signal processing period, estimation of the fluctuation level requiring evaluation of sine and cosine Fresnel integrals over successive time intervals. Figures 1; tables 1; references 2: 1 Russian, 1 Western.

02415/09599

**Time Parameters of Scanning Systems for Detection of Sources of Optical Radiation**

18600045d Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 30, No 9, Sep 87 (manuscript received 15 May 86) pp 23-27

[Article by K. Ye. Rumyantsev]

[Abstract] The problem of optimally designing space-time scanning systems for detection of moving sources of optical radiation so as to minimize scan time and energy is considered, the gist being to optimize the angular overlaps of resolution elements within lines, of lines within frames, and of frames within the scan sector in the receiver optics. Taking into account both static and dynamic components of each overlap, which depend respectively on the statics and the dynamics of the source image, a calculation procedure is shown which yields the optimum numbers of resolution elements, lines, and frames, as well as the sweep time for each. When linear arrays of discrete photocells as resolution elements are used, their static overlap is always negative corresponding to clearance between them and their dynamic overlap is zero. The sweep time for such a resolution element and the necessary line sweep rate in a dissector and in a mosaic system with sequential framewise scanning are calculated, to demonstrate the procedure. Figures 1; references 5: all Russian.

02415/09599

**Phase Characteristics of Excitation Amplifiers With Balanced Stages or With Distributed Gain for Acoustooptic Modulators**

18600045e Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 30, No 9, Sep 87 (manuscript received, after revision, 17 Sep 86) pp 51-53

[Article by Yu. V. Yegorov and V. N. Ushakov]

[Abstract] Excitation amplifiers with balanced stages or with distributed gain have been found to provide adequately high power flatly over an octave band for

acoustooptic modulators in microwave phase-and-frequency meters, an essential requirement being a linear phase-frequency characteristic. Two such amplifiers on a different bipolar transistor each, KT634A-2 and KT923A-2 respectively, between nonidentical collector and emitter stages combining four microstrip line segments and one series capacitor each either balanced or with gain distribution were built and tested after computer-aided design optimization for the 10 cm waveband with adequate gain characteristics. While their calculated phase-frequency characteristics were fairly but not ideally linear, their measured ones were found to deviate from linearity but within acceptable limits over the 1.5-3 GHz frequency range. Both schemes are satisfactory, distributed gain being preferable when most of the phase deviation from linearity is gain-related. Figures 2; references 4: all Russian.

02415/09599

**Adaptive Algorithms of Signal Processing in Space Domain in Modules of Large-Aperture Antenna Array**

18600045b Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 30, No 9, Sep 87 (manuscript received,  
after revision, 25 Aug 86) pp 7-11

[Article by V. N. Manzhos, V. N. Kokin, A. A. Belov,  
and N. I. Kamchatnyy]

[Abstract] Adaptive algorithms are constructed for space processing of signals within individual modules of an antenna array with large aperture, and thus with appreciable lagging of received signals along their envelope. Separate processing of interference signals within the main lobe and the side lobes of a module's radiation pattern is considered, whether or not the main channel is segregated. The algorithms are demonstrated on an antenna array consisting of several equi-ponderant receiver channels, assuming a useful signal with an at least partially known space-time structure submerged in a mixture of intrinsic noise from the receiver channels and interference with parametric apriori indeterminacy from external sources. The key problem is determining the vector of weight factors under linear constraints, namely in fixed directions within a major lobe, which will ensure matched reception of useful signal and interference. This problem, one of conditional extremization, is solved by the method of indeterminate Lagrange multipliers and by estimation of an inverse correlation matrix with the aid of applicable recurrence relations. When compensation channels with radiation patterns dipping to a minimum in the direction of incidence of the useful signal are used in the antenna array, then fluctuations in these channels must be eliminated so as to minimize the total interference power. This is also done with the aid of

applicable recurrence relations. The algorithms have been for efficiency by computer-aided numerical simulation. Figures 3; references 6: 4 Russian, 2 Western (1 in Russian translation).

02415/09599

**Optimization of Signal Processing in Time Domain by Two-Positional Radar System**

18600045k Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 30, No 9, Sep 87 (manuscript received,  
after revision, 30 Jul 86) pp 87-89

[Article by A. G. Rydneyk]

[Abstract] A two-positional radar system with a base much shorter than the maximum target distance and with a repetition rate of probing pulses higher than the wave propagation velocity divided by twice that distance is considered for processing signals from remote targets and passive interference from nearby reflectors, both transmitter and receiver antennas rotating at constant speed in synchronism. The signal-to-interference ratio at the output of the receiver antenna is calculated as a function of the complex signal and interference amplitudes with corresponding vector-columns of weight factors and the interference correlation matrix. The optimum weight vector yielding the maximum signal-to-interference ratio is then determined, assuming plane wavefronts of incident signal and interference. Figures 2; references 2: Russian.

02415/09599

**Differential Smoothing Filter**

18600000c Leningrad IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY:  
PRIBOROSTROYENIYE in Russian Vol 30, No 3,  
Mar 87 (manuscript received 20 Nov 85) pp 43-46

[Article by A.M. Kovalev, V.V. Kruglov, Yu.I. Puchkov,  
and N.P. Prokudnikov, Smolensk Branch, Moscow  
Power Engineering Institute]

[Abstract] An active filter, devised by the authors, for the selection of the constant components of width-modulated pulse sequences is considered which is characterized by an increased speed of response. The article analyzes the operation and presents the basic design relationships of the filter, as well as an example of the filter's employment. The article is recommended by the Department of Automatics and Telemechanics. Figures 5; references: 1 Russian.

6415/9604

**Code-Controlled Digital Scale Display**

18600000c Leningrad IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY:  
PRIBOROSTROYENIYE in Russian Vol 30, No 3, Mar  
87 (manuscript received 4 Nov 85) pp 56-59

[Article by A.S. Shakhkamyani, Yerevan Polytechnical  
Institute imeni K. Marx]

[Abstract] A code-controlled digital scale display for  
digital instruments with analog indicators is described in  
detail with the assistance of a number of diagrams.  
Expressions are presented for calculation of the fre-  
quency of the counting pulses, and the circuits of the  
basic units are presented. The article is recommended by  
the Department of Electronics. Figures 4; references: 1  
Russian.

6415/9604

**Weighted Integration While Measuring  
Instantaneous Values and Derivatives of  
Low-Frequency Signals**

18600000c Leningrad IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY:  
PRIBOROSTROYENIYE in Russian Vol 30, No 3,  
Mar 87 (manuscript received 2 Sep 85) pp 60-64

[Article by I.M. Fedorov, Krasnoyarsk Polytechnical  
Institute]

[Abstract] Piecewise-constant weighted functions,  
with amplitude or duration of half-waves alternating  
in time, are synthesized. Use of these functions  
decreases methodical error because of the averaging  
during determination of derivative and instantaneous  
values of low-frequency signals. The algorithms  
involved are described. The article is recommended  
by the Department of Radio Engineering Systems.  
References 4: 3 Russian, 1 Western.

6415/9604

**Digital Matched Filters for Narrow-Band  
Amplitude-Modulated Signals**

18600000c Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 30, No 1, Jan 87 (manuscript received  
after revision 20 Jan 86) pp 85-87

[Article by I. P. Bukanov]

[Abstract] Synthesis of nonrecursive digital matched  
filters for narrow-band amplitude-modulated signals  
with minimum calculations by cascading is shown to  
be possible, considering a signal  $g_a(t) = A(t)\cos(2\pi f_0 t/T_0)$  with a narrow band of  $2\pi Dgq/gq_0$   
significantly less than 1 and of a duration  $T_s$  equal to  
a whole number of  $K = T_s/T_0$  periods of high-fre-  
quency oscillations (0 less than or equal to  $t$  less than  
 $T_s$ ). Assuming that the envelope amplitude  $A(t)$  varies

slowly in time, the signal during each  $k$ -th period  
becomes  $g_{a_k} = A_k(t)\cos gq_0 t$ . The filter is synthesized  
by cascading filters for signals  $s(t) = \cos gq_0 t$  at 0 less  
than or equal to  $t$  less than  $T_0/(0$  at 0 greater than  $t$   
greater than or equal to  $T_0)$ , with the discretization  
period  $T$  such that  $M = T_0/T$  is a whole number,  
according to the method of synthesizing optimum  
filters for pulse packets. For performance evaluation  
of such a filter, the decrement of the signal-to-noise  
ratio at its output relative to the maximum possible  
decrement is calculated as a function of  $t_{\max}$   
 $A(t)gDgqT_0$  on the basis of applicable energy relations  
and its upper bound is found to remain small within  
the 0-10 range of the argument. Figures 2; references  
4: 3 Russian, 1 Western (in Russian translation).

02415/09599

**Estimate of Upper Bound for Error Factor in  
Linear Channels of Digital Data Transmission  
Systems**

18600000c Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 30, No 1, Jan 87 (manuscript received  
after revision 17 Feb 86) pp 82-85

[Article by G. S. Markaryan]

[Abstract] The upper bound for the error factor  
including nondetectable errors in a digital system  
transmitting linear signals in a multidimensional not  
necessarily binary code is estimated by a reliable new  
method. The method is based on measuring the  
probability of error detection and calculating the not  
precisely measurable probability of nondetection  
according to an analytical relation describing it. The  
error factor is then determined over a long period of  
time equal to  $10^m$  code words, the power exponent  $m$   
representing the attainable accuracy of the estimate of  
error detection probability as well as the speed of the  
estimation method. The apparatus for estimating the  
error factor accordingly includes two decoders, an OR  
gate, a binary counter of complete code words, a  
multiplier, a mantissa (of the error factor) indica-  
tor, a parallel-parallel converter, a bank of three  
switches, and separately a bank of decimal frequency  
dividers, a multiplexer, and an order-of-magnitude  
(of the error factor) indicator, the multiplexer feeding  
another input to the counter and to the multiplier.  
The apparatus is designed to yield the maximum and  
thus worst-case error factor. The method is universal,  
applicable to all codes and all kinds of interference,  
inasmuch as the corrective multiplier is set by the  
bank of switches. Figures 1; references 7: 3 Russian, 4  
Western.

02415/09599

**Use of Modulation Harmonics for Starting Phase-Lock Frequency Control Systems With Two Filtration Channels**

18600000c Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 30, No 1, Jan 87 (manuscript received  
20 Jan 86) pp 74-76

[Article by Ye. S. Bespalov]

[Abstract] Starting and pull-in of a phase-lock frequency control system with two filtration channels in parallel are analyzed, the conventional channel serving to maintain synchronism at carrier frequencies of the input signal as well as oscillations of the controlled oscillator and the other channel consisting of a narrow-band tank circuit tuned to the frequency of sinusoidal modulation. The transient response of such a phase-lock system after frequency modulation has been switched on is calculated, considering that the two channels operate independently when their errors are sufficiently small and that the response of the high-frequency phase-lock loop tuned to the modulation frequency is independent of the low-frequency phase-lock loop when the error of the latter is sufficiently small. The accordingly short differential equation for the error transient in the high-frequency loop is simulated, this equation with a  $2KJ_1(x)$  term on one side ( $J_1$  - Bessel function of first kind and first order,  $x$ -error) representing a suboptimum transient in the linear mode only and this Bessel function being preferably replaced with a function  $f(x)=\pm M$  when  $x$  is greater than or equal to  $(x_c)$ , 0 when  $x$  is less than  $(x_c)$  ( $x_c$  - critical magnitude of error) for the nonlinear mode of modulation starting. This function is generated by extraction of an  $n$ -th harmonic from the output voltage of the phase detector and division of its frequency by  $n$ . The resulting sinusoidal voltage

is applied to the  $f(x)$  terminal of the switch to the  $K/1$  plus  $p$  component of the high-frequency loop for both amplitude and phase corrections. Figures 3; references 4: 3 Russian, 1 Western.

02415/09599

**Using Apparatus of Structural Functions for Synthesis of Automatic Frequency Control Systems**

18600000c Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 30, No 1, Jan 87 (manuscript received  
after revision 27 Jan 86) pp 51-56

[Article by V. V. Akimtsev and V. M. Lapshin]

[Abstract] For analysis of automatic frequency control systems requiring determination of the statistical characteristics of all generally five noise components in an oscillator which influence its frequency instability (random stray frequency noise, frequency flicker noise, white frequency noise, phase flicker noise, white phase noise), particularly their dispersions and correlation functions, the Kolmogorov apparatus of structural functions is preferable to the Rutman model describing the spectral density of short frequency instabilities. An examination of the properties of structural functions applicable to frequency instability, including those which describe real processes and the corresponding phase process, confirms the expediency of using this apparatus also for synthesis of automatic frequency control systems and for selecting the appropriate performance criterion for their optimization. Figures 2; tables 1; references 9: 7 Russian, 2 Western (in Russian translation).

02415/09599

**Interference-Proof Centralized Traffic Control  
Cable Runs for Track Segments with 2x25 kV  
A.C. Electric Traction**

18600134b Moscow AVTOMATIKA

TELEMEKHANIKA I SVYAZ in Russian No 2,  
Feb 87 pp 11-12

[Article by N.M. Burtsev, candidate of technical sciences, scientific associate, K.A. Lyubimov, candidate of technical sciences, scientific associate, All-Union Scientific Research Institute of Railroad Transportation, and S.A. Popov, candidate of technical sciences, assistant, Moscow Institute of Electrical Communications Engineering]

[Abstract] The advantages of 2x25 kV a.c. electric traction systems, already installed along three heavy-load railroad lines, are higher load capacity, lower energy losses, and higher interference immunity of signalization-centralization-interlocking. The authors have developed a new communication cable SBP  $\epsilon 14 \times 1 \times 1.0$  for

track runs with such an electric traction system. Its design is based on characteristics of the Donetsk railroad line, along which its prototype had been installed for experimental operation. Its main feature is a metal sheath with a low shielding coefficient, an electromagnetic shielding mesh on a moisture-proof plastic shell replacing solid lead or aluminum shells. The optimum shielding coefficient was calculated for electromagnetic compatibility with R65 rails, to match the critical track dimensions, and to satisfy governing All-Union State Standards. When compared with a conventional signalization-centralization-interlocking cable, the new cable saves 704 kg of lead and uses 137 kg less copper per kilometer of track run. The new cable has been certified by the Chief Engineer of Signalization and Communication at the Ministry of Railroads. In its development participated B.N. Pushkarev, senior scientific associate at the All-Union Scientific Research Institute of Railroad Transportation. Figures 1.

2415/12232



**Measurement of Vibration Errors of Linear  
Pendulum Accelerometers, on Angular Vibration  
Stand**

18600208e Leningrad IZVESTIYA VYSSHIKH  
UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in  
Russian Vol 30, No 4, Apr 87 (manuscript received  
20 Dec 85) pp 43-49

[Article by S.F. Knovalov, A.A. Trunov, and A.V. Polynkov,  
Moscow Higher Technical School imeni N.E. Bauman]

[Abstract] A method is presented for measurement of  
vibration errors which make it possible to conduct a sim-  
ple balancing of the accelerometer for its further inves-  
tigation with different angle of deviation of the measur-  
ing axis of the device from plane vibration, as well as to  
distinguish the component part of the vibration errors of  
the accelerometer. the article was recommended by the  
Department of Gyroscopic Instruments and Devices.  
Figures 4; references: 3 Russian.

6415/12232

**Errors of Measurement of Course Angles of Radar Reference Points Because of Inaccurate Stabilization of Antenna Mounting in Bank and Pitch**

18600208f Leningrad IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY:  
PRIBOROSTROYENIYE in Russian  
Vol 30, No 4, Apr 87 (manuscript received 12 Feb 87)  
pp 49-52

[Article by S.D. Subochev, Leningrad Institute of Aviation Instrument Making]

[Abstract] The article considers an error of measurement of the course angle of a radar reference point with respect to the indicator of an aircraft panoramic radar station in a first approximation. It is shown that the error linearly depends on an error of stabilization of an antenna mounting with respect to angles in bank and pitch. Three simple dependences derived in the article are recommended for the solution of problems of aerial navigation. The article was recommended by the Department of Automated Systems of Control. Figures 1; references: 4 Russian.

6415/12232

**Invariant-Group Method for Target Bearing Identification in Triangulation Multiposition Systems of Passive Location**

18600223e Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 32, No 4, Apr 87 (manuscript received 24 Jan 85; after correction 19 Feb 86) pp 755-765

[Article by Yu.G. Bulychev and V.N. Taran]

[Abstract] Based on the invariants of a local one-parameter group shift, a new approach to the identification of target bearings in triangulation multiposition systems of passive location is developed. The significant reduction which results in computing expenditures, as compared with known approaches, and the probability characteristics of the method developed are considered in detail. Figures 1; references: 10 Russian.

6415/12232

**Effect of Base Vibration on Gyrocompass Bearings With Fluid-Torsion-Bar Suspension**

18600000d Leningrad IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY:  
PRIBOROSTROYENIYE in Russian  
Vol 30, No 3, Mar 87 (manuscript received 30 Jan 86)  
pp 33-37

[Article by L.M. Ryzhkov, Kiev Polytechnical Institute]

[Abstract] The effect is considered of horizontal translational base vibration on the precision of a gyrocompass with fluid-torsion-bar suspension. It is shown that reducing the viscosity of the supporting liquid makes it

possible to reduce the effect of base vibration on the precision of gyrocompass bearings. The article is recommended by the Department of Theoretical Mechanics. References: 2 Russian.

6415/9604

**Numerical Analysis of Motion of Solid Bodies in Atmosphere**

18600000d Moscow ZHURNAL VYCHISLITELNOY MATEMATIKI I MATEMATICHESKOY FIZIKI in Russian Vol 27, No 2, Feb 87 (manuscript received after revision 16 Jan 86) pp 272-285

[Article by G.M. Lokhov and S.I. Podzorov, Moscow]

[Abstract] The problem of simulating the motion of a solid body in the atmosphere for the purpose of numerical analysis on a computer is treated as one of constructing the optimum simulation model, in the sense of minimum computer time for solving the equations of motion and thus in the sense of most efficient algorithms. Stiff systems of ordinary differential equations are considered and several methods of their numerical solution are comparatively evaluated for the simplest case of plane motion of a body in flight. Algorithmically fastest are found to be explicit higher-order Runge-Kutta methods, the implicit linear multistep Gear method and the explicit nonlinear A-stable methods being close seconds. The fourth-order Runge-Kutta method is most efficient for solving the asymptotic equations of oscillations during flight with perturbations of the independent variable, the first-order Euler method of broken lines being adequate for such a flight without those perturbations. The algorithms have been put together in the WARHED applied program package. High-speed computers of both "conveyor" type with processors operating sequentially and "matrix" type with processors operating in parallel are available for numerical simulation and analysis, the CRAY-1 representing the first type and the IRIS-80 representing the second type. Figures 3; references: 20 Russian.

2415/9604

**Accuracy Characteristics of Optimal Filtration for Determination of Coordinates of Moving Object**

18600000d Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 32, No 1, Jan 87 (manuscript received 6 Jun 85) pp 89-96

[Article by A. I. Sokolov and Yu. S. Yurchenko]

[Abstract] The plane problem of nonlinear filtration in navigation of moving objects is considered, with measurement of their coordinates generally by the pseudo-ranging method and ranging or difference-ranging as special cases. The corresponding system of two equations describes a nonlinear optimum filter, an expanded Kalman filter, its steady-state solution being analyzed for accuracy by compression of input data for combining

measurement channels and by decomposition of a multidimensional filter into simpler ones. The dependence of the accuracy of locating an object in motion on the accuracy of filtered estimates is evaluated on the basis of corrections by the method of maximum likelihood. Constructing the correlation matrix of errors is reduced to constructing a matrix of phase mismatch and a matrix of filter input noise. The procedure is demonstrated on a numerical example. References 8: 6 Russian, 2 Western (1 in Russian translation).

02415/09599

**Statistical Characteristics of Radar Images of Fluctuating Ground Surfaces**

18600000d Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 32, No 1, Jan 87* (manuscript received 8 Apr 85) pp 69-76

[Article by A. L. Ilin and A. Ya. Pasmurov]

[Abstract] Probing of the earth's surface by means of a radar with synthesized aperture is considered, such a radar being mounted on a carrier which moves above the

surface rectilinearly at a constant velocity. The surface is assumed to contain objects distributed in space and varying in time, such as plants and open water in windy weather. The statistical characteristics of radar images of surface segments are derived from their energy spectra of intensity, first without and then with noncoherent signal buildup on the hologram. These characteristics are found not to depend on the degree of coherence of surface objects and to be almost the same as those of noise in the radar aperture. The signal-to-noise ratio on a radar image of a surface segment is found to be almost independent of the length of the synthesized aperture and of the level of noncoherent signal buildup. The results are applicable to quantitative estimates of image smoothness in the case of noncoherent signal buildup, such a buildup on the hologram not influencing the statistical characteristics of radar images when the width of the integrating function does not exceed the space correlation interval on the hologram. Figures 3; references 9: 5 Russian, 4 Western (1 in Russian translation).

02415/09599

**Properties of Analytically Designed Systems with Digital Regulators**

18600208a Leningrad IZVESTIYA VYSSHIKH

UCHEBNIKH ZAVEDENIY:

PRIBOROSTROYENIYE in Russian

Vol 30, No 4, Apr 87 (manuscript received 30 Jan 86)  
pp 13-17

[Article by A.G. Aleksandrov and V.N. Chestnov, Saratov Polytechnical Institute]

[Abstract] The article investigates the frequency properties stability with respect to phase and modulus) of linear discrete systems with one control, the regulators of which are obtained on the basis of the solution of the discrete matrix-equations of A.M. Lyapunov and equations of the Riccati type of a special form. Restrictions are established on the class of non-linearity, the presence of which in the control loop does not violate asymptotic stability in the overall closed system with the constructed linear regulators. The article was recommended by the Department of Automatics and Telecommunications. References 5: 3 Russian, 2 Western.

6415/12232

**Synthesis of Structure of Two-Channel Servo Systems**

18600208b Leningrad IZVESTIYA VYSSHIKH

UCHEBNIKH ZAVEDENIY:

PRIBOROSTROYENIYE in Russian

Vol 30, No 4, Apr 87 (manuscript received 4 Oct 1986)  
pp 21-25

[Article by B.I. Kuznetsov, Ukrainian Correspondence Polytechnical Institute imeni I.Z. Sokalov]

[Abstract] The article considers problems of the synthesizing of the structure of two-channel servo systems in which the amplification factors of the individual channels are multiplied and their orders of servo are established. An example is given of the use of a synthesized structure. The article was recommended by the Department of Control Systems and Automatization of Industrial Equipment. Figures 3; references: 7 Russian

6415/12232

**Construction of High-Power, Low-Voltage Sources of Secondary Power Supply with Transformerless Input**

18600212h Moscow ELEKTROSVYAZ in Russian

No 4, Apr 87 (manuscript received after revision  
27 Dec 87) pp 59-62

[Article by A.N. Yakushkin, V.I. Khandogin, A.I. Ivanov-Tsyganov, V.V. Prostatin, and B.I. Soldatov]

[Abstract] It is shown that the construction of high-power low-voltage sources of secondary power supply with a transformerless input (SSPTI), based on voltage converters which include series-parallel connection cells, makes it possible: to reduce the overall mass and improve the energy index of the SSPTI; and to simplify the solution of problems of their electromagnetic compatibility because of the distribution in time of the moments of switching of the transistors of the individual cells. These sources are for use with electronic equipment (computers, communication, etc.) Figures 3; references 6: 5 Russian, 1 Western.

6415/12232

**Structure of Optical Control Beam**

18600000e Leningrad IZVESTIYA VYSSHIKH

UCHEBNIKH ZAVEDENIY:

PRIBOROSTROYENIYE in Russian

Vol 30, No 3, Mar 87 (manuscript received 13 Nov 85)  
pp 84-91

[Article by S.T. Tsukerman, Leningrad Institute of Precision Mechanics and Optics]

[Abstract] The article considers the principles of action, the procedure for calculation, and the results of tests of examples of a system of remote control. It is shown that for distance control of the spatial position of machines and other objects up to 400-600 meters, a photodiode modulated beam clearly surpasses a laser beam with respect to the following parameters: 1) Attainable stability of position and precision of control; 2) Magnitude of control field and consumable power; 3) Safety of personnel; and 4) Simplicity and cost of equipment. The article is recommended by the Department of Optoelectronic Devices. Figures 3; references: 8 Russian.

6415/9604

**Three-Coordinate Optoelectronic Protractors**

18600208h Leningrad IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY:  
PRIBOROSTROYENIYE in Russian  
Vol 30, No 4, Apr 87 (manuscript received 13 Feb 86)  
pp 69-78

[Article by E.D. Pankov, Leningrad Institute of Precision Mechanics and Optics]

[Abstract] The article describes the circuits and principles of action of three practically realized three-coordinate optical-electronics protractors, which are believed can be the basic unit for industrial models. Their technical characteristics and metrological possibilities are considered. One design uses charge-coupled array matrices and a processing algorithm based on spatially integrated charges; the second in an optoelectronic device operating in null mode consisting of the angle-measurer, control element and processing block; while the third is an optoelectronic angular difference sensor consisting of two optical blocks for establishing the difference and an electronic block for data representation. The article was recommended by the Department of Optoelectronic Devices. Figures 5; references 39: 29 Russian, 10 Western (1 in Russian translation).

6415/12232

**Optimization of Parameters of Solar System Power Supply for the Cuban Environment**

18600211c Minsk IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: ENERGETIKA in  
Russian No 4, Apr 87 pp 45-49

[Article by V.A. Nikiforov, candidate of technical sciences, and Sanchez Losaro Alberto, Odessa Polytechnical Institute]

[Abstract] A program is developed for a microcomputer and a cycle of optimized calculations of the angle of slope of the slope of the field of solar collectors for Cuban conditions is performed, taking into account only the direct components of the flow of solar radiation. The optimum orientation by a change once a month of the angle of slope of the collector for a year assures additional interception of 0.253 kW at each square meter of the surface of the solar collection, which increases the efficiency of operation of the solar system, and proportionally reduced the expenditure of energy from supplementary sources. The article was presented by the Department of Thermoelectric Power Stations. Figures 3; references: 6 Russian.

6415/12232

**Correlation Between Complex Amplitudes of Noise Spectral Components in Bipolar and Field-Effect Transistors for Large Signals**

18600223f Moscow RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 32, No 4, Apr 87  
(manuscript received 26 Dec 85) pp 779-783

[Article by V.G. Leonov, L.Ya. Mogilevskaye, Yu.L. Khotuntsev, and A.V. Frolov]

[Abstract] Relations are obtained which makes it possible to take into account the cross-correlation of two periodical nonstationary sources of regeneration—recombination noises in a bipolar transistor and diffusion noises in a field-effect transistor. The result is based on the assumption that the periodic nonstationary random process can be presented in the form of the product of a determinant function of time for a stationary random process. It is shown that the correlation relations obtained can be used during calculation of the noises of devices based on bipolar and field-effect transistors operating in a large signal regime. A noise equivalent circuit is shown of a bipolar transistor (including sources of regeneration-recombination noise) and a noise equivalent circuit of a field-effect transistor. Figures 3, References 4: 2 Russian, 2 Western (1 Russian translation).

6415/12232

**Estimating Location of Source Emitting Wideband Signals While Moving Within Fresnel Region of Multiposition Measuring System**

18600158j Moscow RADIOTEKHNIKA in Russian No 2, Feb 87 pp 54-55

[Annotation of article no 953-sv deposited at Central Scientific and Technical Institute 'Informsvyaz,' 8 pp with 2 figures and 6 bibliographical references]

[Article by G.S. Nakhmanson]

[Abstract] The performance of a coherent multiposition measuring system is evaluated in terms of the accuracy with which it locates a target moving within its Fresnel region, assuming that the measuring system has a Cartesian n-element receiver antenna array and that the target emits wideband signals while in motion. An optimum system for space-time processing of these signals is synthesized with presence of instrument noise taken into account. This system generates an output signal proportional to the logarithm of the likelihood-ratio functional as well as to the coordinates of the target and their derivatives. The accuracy of estimates of the target coordinates is characterized by the Fisher matrix, which under conditions of reliable measurement yields the dispersions of simultaneous distance and radial-velocity estimates. The accuracy of a distance estimate made upon space-time processing improves with widening of

the signal spectrum and increasing number of receiver array elements, while the accuracy of a radial velocity estimate is the same as in the case of a conventional active radar.

2415/12232

**Calculation of Losses in Electromagnetic Pulse Betatrons**

18600000f Novocherkassk IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian  
No 3, Mar 87 (manuscript received after revision 22 Oct 85) pp 13-17

[Article by Boris Antonovich Baginskiy, candidate of technical sciences, assistant professor, Tomsk Polytechnical Institute, and Viktor Nikolayevich Makarevich, scientific worker, Tomsk Polytechnical Institute]

[Abstract] In order to reduce the losses of their power supply in electromagnetic pulse betatrons, it is advisable to generate a voltage, the form of which is close to square. As compared with the sinusoidal form of voltage, the losses in the magnetic circuit are diminished by 25 percent, and in the magnetizing winding by 33 percent. With an increase of the pulse ratio of the current pulses, losses in the winding fall, and in the magnetic circuit increase. A pulse ratio exists with which the total losses are minimum and the ratio of losses in the winding to the losses in the magnetic circuit, corresponding to this pulse duty factor lies in the range 0.5-1. Figures 4; references: 4 Russian.

6415/9604

**Optoelectronic Components for Optical Connection in Integrated Circuits (Survey)**

18600000f Moscow MIKROELEKTRONIKA in Russian  
Vol 16, No 3, Mar-Apr 87 (manuscript received 20 Jun 86) pp 99-111

[Article by M.I. Yelinson, A.A. Sukhanov, and I.N. Dyuzhikov, Institute of Radio Engineering and Electronics, USSR Academy of Sciences]

[Abstract] The results of work accomplished recently with respect to optoelectronic components are summarized. The following items are considered in detail: 1) Photodetectors for optical interconnections (basic requirements, photoresistors, photodiodes, phototransistors); 2) Modulators; and 3) Monolithic integration of optoelectronic devices and logical units. Figures 4; references 107: 14 Russian, 93 Western.

6415/9604

**Television: Control of Kinescopes With Self-Convergence of Beams**

18600000f Moscow RADIO in Russian  
No 3, mar 87 pp 39-40

[Article by S. Yelyashkevich, Moscow]

[Abstract] Because of disturbance of the mounting of the deflecting system, particularly during removal of its mantle ring, and of the bias of the magnetostatic device in 61LK5Ts and 51LK2Ts kinescopes with self-convergence of beams, the color purity and the static and dynamic convergence deteriorate. The article discusses methods for their restoration when it is necessary to dismantle the deflecting system and the magnetostatic device from the kinescope, and again to install and adjust them. Figures 2.

6415/9604

**Voltage Supply Module for Gas-Discharge Flash Lamp of Automated Microphotographic Attachment**

18600000e Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 1, Jan 87  
(manuscript received 12 May 86) pp 28-30

[Article by V. A. Kalachikov]

[Abstract] A special voltage supply for the gas-discharge lamp of a microphotographic attachment to a microscope has been developed, on the premise that flash microphotography of fast moving or fast varying objects under a microscope requires equipment which will produce high-quality images on negatives in the shortest possible exposure time and will allow regulation of the flash energy depending on the optical properties of the film material as well as on the photometric characteristics of the object. The principal two components of this voltage supply module, a power pack and a control pack, are designed for operation with DKsSh-120 or DKsSh-150 xenon lamps. A photocell and electronic circuitry are included for measurement of the incident luminous flux and for triggering the shutter control pulse exactly at the instant when the optimum exposure time has been reached. The module was tested and found to operate satisfactorily with an MFNE-1 microphotographic attachment produced by the Leningrad Optomechanics Association and with a LYuMAM-K microscope. Figures 2; references: 3 Russian.

02415/09599

**Effect of Quantization of Measurement of Threshold Sensitivity of Optoelectronic Device**

18600000e Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 1, Jan 87  
(manuscript received 7 Jun 86) pp 5-9

[Article by Ye. I. Platonova]

[Abstract] The performance of an optoelectronic device behind an analog-to-digital converter is analyzed, for the purpose of determining the effect of quantization on its

threshold sensitivity. Quantization of a random input process by the converter is assumed to be uniform. Although such a quantizer is a nonlinear component, quantitative estimates of the signal-to-noise ratio and of the quantization noise parameters, namely its mathematical expectation and standard deviation as functions of the quantization step, indicate that the linearization procedure for determining the threshold sensitivity is applicable here with appropriate corrections such as the Sheppard correction. In the case of large quantization steps it is necessary to reconstruct input signals to the converter from readings at the output of the optoelectronic device, the Sheppard correction being inadequate then and even yielding absurd results. Figures 4; references 2: 1 Russian, 1 Western (in Russian translation).

02415/09599

**Dependence of Threshold Sensitivity of  
Optoelectronic Device in Presence of External  
Interference on Device Parameters**

18600000e Leningrad OPTIKO-MEKHANICHESKAYA  
PROMYSHLENNOST in Russian No 1, Jan 87  
(manuscript received 12 Jun 86) pp 1-5

[Article by Ye. F. Demidov and E. V. Sharkova]

[Abstract] The performance of an optoelectronic device in the presence of not only non-white internal noise but also external background interference is analyzed on the basis of fundamental relations which yield the threshold sensitivity of such a device consisting of a photodetector array and an objective. The dependence of this threshold sensitivity on parameters of the device such as loss factor, dimensions of the photodetector, relative aperture of the objective, scanning rate, and signal storage number is determined for the purpose of design analysis.

Its dependence on each parameter is, accordingly, calculated for several constant values of other parameters and then plotted as a set of curves. Figures 4; references: 4 Russian.

02415/09599

**Possibilities of Increasing Current in Multibeam  
Image Converters With Centrifugal-Electrostatic  
Beam Shaping**

18600000e Moscow RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 32, No 1, Jan 87  
(manuscript received 7 Feb 84) pp 213-217

[Article by L. I. Andrikanis, N. S. Bunina, and M. Z. Melikov]

[Abstract] Ways to increase the current in a double-beam twin image converter with centrifugal-electrostatic beam shaping are examined, one variant being a layout with ribbon cathodes mounted on a forming ring electrode so that ribbon electron beams diverge into the cylindrical space each after leaving its cathode from both sides and then passing around its pair of anodes followed by a pair of shielding electrodes. Calculations for numerical design and performance analysis based on field plotting with current passage and with current cutoff were made on a BESM high-speed computer according to the KSI program. An experimental study was made on a laboratory test stand, with the image converter in the regenerative mode. The results have yielded the dependence of the collector current-voltage characteristic on the converter sector angle, typically 10SD or 15SD, for a cylinder with a 160 mm radius and a high-voltage gap 60 mm wide. They also indicate the closest permissible proximity of converter sectors operating in the regenerative mode. Figures 4; references: 5 Russian.

02415/09599

**Automatization of Initial Loading of  
Microcomputer Elektronika-NTs-03D**

18600208c Leningrad IZVESTIYA VYSSHIKH

UCHEBNIKH ZAVEDENIY:

PRIBOROSTROYENIYE in Russian

Vol 30, No 4, Apr 87 (manuscript received 29 May 87)  
pp 34-37

[Article by O.V. Botvinnikov and A.N. Osokin, Tomsk  
Polytechnical Institute imeni S.M. Kirova]

[Abstract] The module for initial loading of programs into of Elektronika-NTs-03D microcomputer provides high reliability and acceleration of the loading process; and makes it possible to reduce the requirements on training the users of the microcomputer, and to widen the area of employment of the microcomputer. A block diagram and algorithm for the module are shown and described. The article was recommended by the Department of Computer Technology. Figures 3; references: 2 Russian.

6415/12232

**Selection of Microprocessor With Optimum  
Quick-Acting Realization of Algorithm**

18600000g Leningrad IZVESTIYA VYSSHIKH

UCHEBNIKH ZAVEDENIY:

PRIBOROSTROYENIYE in Russian Vol 30, No 3,

Mar 87 (manuscript received 2 Jun 86) pp 28-32

[Article by A.Ye. Borzenko and V.P. Koryachko, Ryazan  
Radio Engineering Institute]

[Abstract] The article considers a procedure for determination of an optimum quick-acting microprocessor for solution of certain types of problems. A method is considered which, based on an analysis of the structure of a realizable algorithm and selection of a time-table schedule for its realization, minimizes the total idle time of the required unit. An example is given of the selection of a microprocessor for a system of operational control of complex electronic equipment. The article is recommended by the Department of Design of Computer Equipment. Figures 3; references: 9 Russian.

6415/9604



**Performance of Self-Oscillating Converter of Microwave Signals**

18600000f Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 30, No 1, Jan 87 (manuscript received  
after revision 14 Jan 86) pp 93-95

[Article by Yu. I. Alekseyev]

[Abstract] The performance of a converter of microwave radio signals is evaluated on the basis of the three-frequency model of a self-oscillating converter with a Gunn-effect diode. The theoretical analysis begins with an expression for the steady-state amplitude of a composite forced converter oscillation, assuming that the amplitude of the input signal and the amplitude of the output signal are much smaller than the amplitude of the oscillator voltage across the nonlinear diode. Calculations for a 3A720A Gunn-effect diode, with the aid of its current-voltage characteristic and derivatives of the approximating function, have yielded the frequency characteristics of the conversion loss and the converter conductances. That of the conductances is found to depend on the magnitude of the feedback factor,  $g_{gq}$  increasing and  $g_{gq-gq(s)}$  decreasing as the latter increases. These theoretical results agree closely with the results of measurements. Figures 2; references 3: 2 Russian, 1 Western.

02415/09599

**Characteristics of Frequency-Selective Nonlinear Effects in Microwave Radio Devices**

18600000f Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 30, No 1, Jan 87 (manuscript received  
after revision 14 Mar 86) pp 35-41

[Article by M. A. Ivanov]

[Abstract] Frequency-selective effects in nonlinear inductive microwave radio devices with single input and output are analyzed by expressing the output process as a Volterra-series functional of the input process, assuming that the device has constant in time characteristics which are analytic or reducible to such. The analysis is based on the theory of multidimensional Fourier transformations. The results pertaining to digital devices indicate that the inertia of nonlinear conversion of discrete signals can increase both level and depth of their intersymbol distortions. Nonlinearity can also disturb the conditions for selectivity as well as cause crosstalk between cophasal and quadrature channels. In order to minimize these detrimental effects, it is necessary to decrease the number of stages, especially the number of inductive filter circuits, and/or the physical length of the data transmission line, also to improve the symmetry of frequency characteristics with respect to the center frequency of the pass band and to provide extra pass band margin. Frequency-selective nonlinear processes have

sometimes a favorable effect, namely in frequency-selective limiting of the radio signal level by means such as direct absorption with the aid of electron-paramagnetic resonance and with the nonlinear components concentrated within a relatively narrow absorption band. A mathematically adequate functional model has been constructed which covers almost all known types of frequency-selective limiters, including ferrite devices with parametric generation of subharmonics on the basis of third-order nonlinearity. Figures 1; references 6: 5 Russian, 1 Western.

02415/09599

**Band-Pass Filters Based on Planar Metal-Dielectric Structures in E-Plane of Rectangular Waveguide: Review**

18600000f Kiev IZVESTIYA VYSSHIKH  
UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 30, No 1, Jan 87 (manuscript received  
after revision 13 May 86) pp 3-15

[Article by V. P. Gololobov and M. Yu. Omelyanenko]

[Abstract] Design and performance characteristics of microwave band-pass filters with low insertion loss produced in planar rectangular metal or metal-dielectric waveguide structures are reviewed on the basis of the state of the art and original studies. Filters with half-wave resonators are examined from the standpoint of applicable theoretical models and experimental data, such filters performing better with widened rejection bands than with simple inductive strips, taking into account the effect of losses as well as of design and manufacturing imprecision. An extended version of such filters are multilayer ones in metal structures. In addition to various configurations of band-pass filters in planar metal or metal-dielectric waveguides, completely or partially filled, there are other known types including strip lines on "hanging" substrates and asymmetric microstrip lines. Figures 13; tables 2; references 44: 9 Russian, 35 Western (2 in Russian translation).

02415/09599

**Splice for Coupling Laser to Single-Mode Optical Waveguide**

18600000f Leningrad OPTIKO-MEKHANICHESKAYA  
PROMYSHLENNOST in Russian No 1, Jan 87  
(manuscript received 31 Oct 85) pp 32-33

[Article by S. D. Kolomeyets, A. Yu. Krivoshlykov, V. O. Smirnov, and G. S. Tymchik]

[Abstract] A splice for coupling an instrument laser to a single-mode optical waveguide has been developed and tested which features a high immunity to temperature fluctuations and mechanical vibrations. It was built for joining an LGN-208A He-Ne laser ( $\lambda = 0.6328$  gmm wavelength) to a 1.5 m long optical fiber with a core 6 gmm in diameter and with a 3 gmm effective mode

radius. The protective polymer coating on the fiber was removed by heating and the residual scale was removed by dissolution in alcohol. Formation of a speckle pattern in the laser beam at the fiber exit was prevented and a spatially uniform wavefront was ensured by cutting the fiber with high precision perpendicularly to its axis and finishing the end face to a high degree of smoothness. Cutting the core, after notching it with a sapphire needle, was found to be preferable to grinding and polishing. The fiber was coupled to the exit mirror of the laser resonator through a flexible sleeve of polyvinyl chloride serving also as mechanical protection and passing through V-grooves in two halves of a prism serving as a clamp. A threaded step-down transition was glued with ED-2 epoxy resin to the laser chamber. The focusing lens and the collimating lens were glued to respective mountings, the one with the focusing lens being screwed onto the transition. Appropriate sequencing of operations ensures a rigid assembly of the optical system and proper selection of the prism material, ST-1 acrylic glass, facilitates its alignment. The correctness of such a splice was confirmed by photometric determination of the luminous flux distribution over the fiber exit aperture with a photoreceiver array of 256 charge-coupled devices, an S1-70 oscillograph, an A611 analog-to-digital converter and an M-6000 minicomputer processor. Figures 2; references 1: Western (in Russian translation).

02415/09599

**Production of Thin-Film Waveguides by Sputtering of Target With Neutral Ion Beam**  
18600000f Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian, No 1, Jan 87  
(manuscript received 14 Mar 86) pp 20-22

[Article by G. A. Muranova and A. F. Perveyev]

[Abstract] In view of the fact that in thin-film integrated-optics waveguides the principal causes of attenuation are scattering of light by grains in the film structure and by the film-air interface, ion-beam sputtering of the target material is considered in preference to less precise processes such as thermal vacuum deposition, electron-beam evaporation, high-frequency sputtering, or ion-beam surface polishing. The apparatus for producing thin films by this process consists of a separate Kaufman ion source with a thermionic tungsten cathode inside a cylindrical hollow anode and a vacuum chamber with the target on a turntable and the substrate on a rotating shaft inside. A magnetic field across the interelectrode gap makes electrons move along cycloidal trajectories, for more effective ionization, whereupon the discharge is drawn through an array of molybdenum grids into the vacuum chamber in the form of an ion beam with fairly uniform current density. The turntable with the target is

water cooled and the space charge above it is compensated by a neutralizer. This method of sputtering ensures a fairly uniform deposition of films from targets of multicomponent materials such as glasses because, while particles of faster components are deposited, particles of lower components form a relief before being subsequently also deposited in accordance with the angle dependence of the sputtering rate. Spectral analysis and measurements at vacuum-ultraviolet wavelengths have confirmed that the composition of films deposited in this way is very close to the composition of the targets. The vapor phase, moreover, does not contain macroparticles. Sputtering of  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ , quartz glasses, aluminosilicate glasses, phosphate glasses, and glasses activated with  $\text{Nd}^{3+}$  or  $\text{Eu}^{3+}$  ions by this method with the optimum ion current density  $1.2 \text{ mA/cm}^2$  has yielded optical films building up at a rate of 200-300 Angstroms/min. An attenuation coefficient lower than  $1 \text{ cm}^{-1}$  was found to be attainable, measurements having been made with a He-Ne laser at two power levels and by the photometric method with two lead-out prisms. Figures 2; tables 1; references 5: 3 Russian, 2 Western (1 in Russian translation).

02415/09599

**Nonstationary Processes in Generator of Millimetric Surface Wave**  
18600000f Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 32, No 1, Jan 87  
(manuscript received 21 Nov 85) pp 118-126

[Article by A. M. Afonin, V. A. Vdovin, V. I. Kanavets, A. D. Poyezd, S. A. Sokolov, and V. A. Cherepenin]

[Abstract] Interaction of an annular relativistic electron flux and the electric field in a tuned retarding structure is evaluated on the basis of theoretical analysis and experimental data applicable to a generator of millimetric surface waves. Theoretical analysis of the electron ballistics involves solution of two equations with momentum as one coordinate, which has been done by numerical simulation, considering that the longitudinal electric field consists of a vortex component and a Coulomb component. The experiment was performed with an irised waveguide as retarding structure, using a 150 kV miniaccelerator based on a MIRA-2D commercial x-ray machine for electron injection, a tubular scintillation cathode in a holder with a glass insulator, and a supercritical construction for the  $E_{01}$ -mode. With this equipment were generated 3.5 MW radiation pulses at the  $gl = 8 \text{ mm}$  wavelength and of  $gt = 5 \text{ ns}$  duration, the efficiency reaching 4 percent, for performance and design analysis of a relativistic surface-microwave generator. Figures 5; references: 10 Russian.

02415/09599

**Results of Laboratory Tests of IKM-480 High-Frequency Balanced Cable Transmission System**

18600212d Moscow ELEKTROSVYAZ in Russian  
No 4, Apr 87 (manuscript received after revision  
12 May 86) pp 25-30

[Article by M. Brandes, German Democratic Republic]

[Abstract] Laboratory tests of the linear channel of the IKM-480 showed that by virtue of the use of a 5B6B linear signal it is possible to transmit pulse-code modulation (PCM) signals with a speed of 34,368 MBit/sec through high-speed symmetrical cables with relatively poor characteristics of the mutual effects. In addition various principles were tested of the realization of the auxiliary functions necessary in a system with PCM. The accumulated experience will be used for further improvement of the equipment and of its system parameters. Realization of the IKM-480 based on high-frequency 4-quadded symmetrical cables makes it possible to increase the effectiveness of their employment 4-8 times in comparison with 120- and 60-channel analog transmission systems, and makes possible the organization of them of cables with up to 3,840 channels of voice frequency. Figures 8; references 4: 3 Russian, 1 Western.

6415/12232

**Results of Work of Eleventh Research Commission of the International Telegraph and Telephone Consultative Committee (CCITT) for the Period 1981-1984**

18600212a Moscow ELEKTROSVYAZ in Russian  
No 4, Apr 87 pp 16-18

[Article by M.A. Zharkov]

[Abstract] Creation of the Integrated Service Digital Network (ISDN) introduction of new types of service and organization of digital networks reaching as far as subscriber installations are the principal directions of the technical improvement of telecommunication network developments. In the 1981-1984 research period, the Eleventh Research Commission of the CCITT considered 19 problems principally concerned with: Construction of digital switching systems; their programs; contact of persons with a machine; development of an algorithm for interaction of subscriber devices with digital subscriber lines; and the composition and parameters of the signals and codes, i.e., development of digital access to the ISDN network. For solution of these problems, within the framework of the Eleventh Research Commission six working groups were formed which reviewed 107 existent recommendations and proposed 50 new ones, 13 new supplements, and 2 instructions.

6415/12232

**Compact Receiving and Transmitting Modules for 4 Gigahertz Radio-Relay Lines**

18600212b Moscow ELEKTROSVYAZ in Russian  
No 4, Apr 87 (manuscript received 15 Aug 86) pp 19-21

[Article by L.G. Gassanov, A.P. Protopopov, V.I. Cherepukhin, and A.A. Lipatov]

[Abstract] In the construction and operation of radio-relay lines in mountainous and unpopulated regions in rayons of the far north, particularly urgent problems are the reduction of capital and labor expenditures, the consumption of nonferrous metals, energy consumption, and simplification of assembly and adjustment of equipment. Solution of these problems proceeds by way of the creation of autonomous, small-scale, highly-efficient solid-state transceiving equipment which provides: acquisition of the necessary power potential of a radio line with location of receiving and transmitting modules of small dimensions and mass near an antenna reflector with the possibility of their supply from storage batteries, solar batteries, thermoelectric generators, etc. In practice, use of such equipment eliminates the necessity for creating life-support conditions for attendants, construction of sidings, delivery of fuel to medium size stations, etc. The modules for 4 Hz range described in the article, which were created on the basis of the application of existing microelectronic technology, confirm the possibility of solving the problems mentioned above. Figures 2; references: 1 Russian.

6415/12232

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application of existing microelectronic technology, confirm the possibility of solving the problems mentioned above. Figures 2; references: 1 Russian.

6415/12232

**Autocorrelation Reception of Composite Signals on Digital Tropospheric Communication Lines**

18600212c Moscow ELEKTROSVYAZ in Russian  
No 4, Apr 87 (manuscript received after revision  
4 Mar 86) pp 21-24

[Article by V.V. Bortnikov and A.V. Romanov]

[Abstract] Synthesis of an autocorrelation reception system under conditions of a posteriori signal and noise independence is described. Analysis of the noiseproof system of autocorrelation reception of compound frequency modulation signals functioning under conditions of fluctuating and concentrated noise indicates its high efficiency over a range of speeds of information transmission. The presence in the receiver of adaptive filters and a current feedback program make it possible to recommend it for use as a unified device over a wide range of information transmission speeds. The receiver described can be implemented on the basis of existing elements for analog processing of signals, or by means of microprocessors. Figures 3; references: 9 Russian.

6415/12232

**Status and Prospects for Development of Digital Transmission Systems (Survey)**

18600212e Moscow ELEKTROSVYAZ in Russian  
No 4, Apr 87 (manuscript received 12 May 86) pp 31-36

[Article by E.V. Kordonskiy]

[Abstract] This survey is basically devoted to consideration of the distinctive features of the use of recently developed channel and group formation digital transmission systems, as well as the equipment of digital linear channels using metal cables. The survey does not cover the principles of construction and operation of the equipment. Development in the U.S., Europe and Japan are considered. Equipment for interfacing digital transmission equipment in preexisting analog systems is also surveyed. References 32: 16 Russian, 16 Western.

6415/12232

**Zonal Simplex Radio Networks of Transport-Train Radio Stations System**

18600228a Moscow AVTOMATIKA  
TELEMEKHANIKA I SVYAZ in Russian  
No 5, May 87 pp 4-9

[Article by Yu.V. Vavanov, manager of Department for Information Transmission in Control Systems of All-Union Scientific-Research Institute of Railway Transportation, candidate of technical sciences and Yu.I. Klevanskiy, engineer]

[Abstract] The article is concerned with the Transport-Train Radio Station, which together with a control rooms duplex (See ATIS, 1986, No 10) and simplex

linear radio networks includes zonal simplex radio networks. They ensure radio communication for the engineers of train locomotives with respect to crossings and workers along sections; and facilitate traffic functions, freight security, and services for passengers (see ATIS, 1985, No 3). These radio networks are organized in the meter wave band (160 MHz) with the help of stationary, mobile, and portable radio stations which operate in a regime of single-frequency simplex and assure two-way radio communication with a group call. The following items are considered in detail: 1) radio network for engineer of train locomotive; 2) other zone networks of train radio stations; and 3) stages of introduction of radio networks. Figures 3.

6415/12232

**Central Control Unit of Automatic Telephone Stations of Kvant Quasielectronic Systems**

18600228b Moscow AVTOMATIKA  
TELEMEKHANIKA I SVYAZ in Russian  
No 5, May 87 pp 15-17

[Article by A.A. Pavlovskiy, engineer]

[Abstract] The article describes quasielectronic automatic telephone stations of the Kvant type which employ a central control with a recorded program. All the processes of information analysis, acceptance of decisions, and organizing control signals are concentrated in the central control unit (CCU). An algorithm of the CCU operation, in the form of programs, is stored in coded form in a memory unit. Together with servicing of telephone calls, the control unit of the quasielectronic automatic station carries out operation of equipment, malfunction searches, and collects statistical information. A block diagram is shown of the control unit and linkages. Hexadecimal notations is used for coding. Any 16 bit sequence can be a command, a number or a state code depending upon the decision by the programming. Figures 2.

6415/12232

**Our Method of Measuring Communication Lines of the K-60p Transmission**

18600228d Moscow AVTOMATIKA  
TELEMEKHANIKA I SVYAZ in Russian  
No 5, May 87 pp 28-29

[Article by M.D. Vaskovich, chief of section, 5th Minsk Division of the Belorussian Railroad]

[Abstract] Up to now technology for conducting measurements and control of the communication lines of the K-60p transmission system has not been developed. Consequently, in practice a method designed for control of Type B-12 and other equipment is used. Measurement of the amplitude-frequency response of the line of the

K-60p transmission system, rapidly and with high quality is a complex problem. A method which was developed and is in use in the author's division, is described which makes it possible considerably to reduce the time, and considerably to improve the quality of measurement, as well as to increase the productivity of work of engineer-measurers. The method involves simultaneous measurement of the amplitude-frequency characteristic at all repeater points simultaneously.

6415/12232

**Design of Unified Telegraph Communication and Data Transmission Network**

18600134a Moscow AVTOMATIKA  
TELEMEKHANIKA I SVYAZ in Russian No 2,  
Feb 87 pp 9-11

[Article by V.A. Kudryashov, candidate of technical sciences, assistant professor, Leningrad Institute of Railroad Transportation Engineers]

[Abstract] The existing railroad telegraph communication network can be combined with a data transmission network, such a unified network being required to operate at the conventional 50 baud rate as well as at 100, 200, 600, 1200 baud or even higher rates and to transmit data with an error probability not beyond the  $1.10^{-6}$ - $3.10^{-5}$  range. Electronic channel switching and video terminals are envisioned along with frequency division of channels (TT-144 equipment) and gradual conversion to time division of channels (high-capacity multichannel DUMKA equipment, also KIT and MOST equipment). Other features of such a unified network will include automatic monitoring of subscriber and interstation line segments. Its structure and topology will conform to the organization of railroad traffic control with a correspondingly three-level hierarchy of the switching system, including computer-aided switching at the intermediate level. The switching method at each level needs to be selected on the basis of maximum advantage. Channel switching offers fast connection and interactive communication, but is not most economical. Message switching is characterized by a high utilization factor, but only where delays are permissible. Packet switching is suitable for adaptive transmission route selection and is characterized by small delays. A typical unified network will have concentrators connected to subscriber and public exchanges at the lowest level, traffic control switching centers at the intermediate level, and zonal trunk switching centers at the highest level. Design and layout of such a unified network will require statistical performances and service and availability analysis. Figures 2.

2415/12232

**Integrated Rural Communication Network**

18600049a Moscow VETNIK SVYAZI in Russian  
No 10, Oct 87 pp 23-25

[Article by Ye.M. Kuznetsov, chief, 'Istok' (source) group, Smolensk Regional Production-Engineering Management of Communications]

[Abstract] The integrated rural telephone networks have been recently installed in the Smolensk Oblast with one central station each, one in the Dukhovshchinskiy Rayon having three terminal stations and one in the Monastyrshchinskiy Rayon having five terminal stations. Their operation is monitored and their equipment is routinely inspected by a UK4310 control system using special-purpose technical service programs. Experience with operating similar networks, particularly the one in the Suvorovskiy Rayon of the MSSR, has revealed that secondary power supplies as well as relay matrixes and coordinate decoders are the most vulnerable equipment components. This hardware has, therefore, been redesigned for higher reliability and passed through more careful quality control prior to installation. Also adequate standby and replacement capability has been provided. The functional software, however, needs to be periodically modified on the basis of available operating data and future service projections. This problem, along with many others, requires greater involvement of the USSR Ministry of Communications than it now receives.

2415/12913

**Monitor of Data Preparation**

18600049b Moscow RADIO in Russian  
No 9, Sep 87 p 28

[Article by A.YA. Yavich, chief, Department of Technical Service, Republican Information and Computation Center, LaSSR Ministry of Communications]

[Abstract] A monitor of data preparation by YeS-9004 devices for a computer has been developed on the basis of an Elektronika K1-20 microprocessor with a 12 kbyte programmable read-only memory. It checks data recorded on magnetic tape for errors, which are then corrected manually prior to transmission of the data. The monitor is designed for operation in local and long-distance as well as postal telephone networks. Its major feature is use of two YeS-9004 devices with keyboard and display each, coupled to the microprocessor one for recording and for reading in addition to all other functions each performs. The monitor needs careful and extensive preparation for service, an operator can learn how to handle it in approximately 2 h. Figures 3.

2415/12913

**Introduction of IKM-120A  
Pulse-Code-Modulation Equipment**

18600000g Moscow VESTNIK SVYAZI in Russian  
No 1, Jan 87 pp 30-31

[Article by V. I. Ukhlov, chief, production laboratory, Voronezh Production and Engineering Administration for Communications]

[Abstract] Introduction of IKM-120A pulse-code-modulation equipment for secondary digital data transmission over 120 channels requires adaptation of existing facilities, most critical and difficult being preparatory jobs in unattended repeater stations. Special measurements of attenuation at the nominal 4.224 MHz frequency are necessary, in order to ensure matching, with remoteness of power supply taken into account. The next step is installation of moisture-proof line cables with maximum smoothness along the entire path, especially avoiding discontinuities 17-30 m apart or from a repeater point. All this is much simpler than adaptation to frequency-modulation equipment.

02415/09599

**Model ALAP-M Monitor for Subscriber Lines**

18600000g Moscow VESTNIK SVYAZI in Russian  
No 1, Jan 87 pp 28-29

[Article by Ye. I. Alperovich, design engineer, Special Design and Manufacturing Engineering Office, Donetsk Institute of Engineering Physics, UkSSR Academy of Sciences, V. D. Bakhmatskiy, section manager, S. M. Bolshinskiy, chief designer, A. N. Poltava, design engineer, V. N. Solenyy, section manager, and I. S. Ostapenko, chief engineer, Donetsk City Telephone Network]

[Abstract] The model ALAP-M monitor for subscribers' telephone lines ensures connection to a telegraph network and to a group selector for automatic message accounting device while it checks station and line equipment. Its direct-access memory stores data for transmission on standard order forms upon request from any teletype. It also records errors made by the group selector during dialing, its interface with the latter and that with the telegraph network being galvanically isolated from one another. The monitor processes the results of insulation resistance and d.c. voltage measurements, for which purpose it includes a voltage comparator, and analog current transducer, and an analog-to-digital converter. Most of the hardware is built on series KR5801K55 microcircuit chips. The algorithms of three operating modes, "test," "measure," "print," have been programmed in PL/M language for the read-only memory with an SM-1800 8-kbyte disk operating system. The monitor was tested with units, tens, hundreds groups of subscriber lines as well as with all coin telephones of ATS-58, ATS-55, ATS-92, ATS-94 stations. Figures 2; tables 1.

02415/09599

**Interference Immunity of Correlational Reception  
of Amplitude- and Phase-Modulated  
Pseudorandom Signals**

18600000g Moscow RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 32, No 1, Jan 87  
(manuscript received after revision 29 Jan 85) pp 62-68

[Article by A. M. Chudnov]

[Abstract] A law of amplitude and phase modulation is sought for pseudorandom signals which will make the probability of their incorrect discrimination depend only on the signal readout to interference readout energy ratio based on the signal duration. A model of a data transmission system is constructed for this purpose which consists of a data generator, a pseudorandom modulator, a semi-continuous communication channel, a discriminator, and a data receiver in succession. The conditional probability of incorrect signal discrimination is estimated for the found algorithm of signal formation and reception, on the basis of the channel parameters using that energy criterion and assuming equiprobable arrival of signals. The interference immunity is then calculated first for coherent interference action and then for non-coherent interference action. The author thanks A. P. Rodimov, V. I. Korzhik, and L. M. Fink for support, many discussions, and several helpful suggestions. Figures 1; references 13: 10 Russian, 3 Western.

02415/09599

621.395.345

**Equipment for Connection Lines of Quantum  
Cross-bar Type Automatic Telephone Exchange**

18600000 Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 3  
Mar 87, pp 12-15

[Article by S. L. Dyufur, professor, Leningrad Institute of Railroad Transportation Engineers imeni Academician V. N. Obraztsov, doctor of technical sciences, and A. K. Lebedinskiy, candidate of technical sciences]

[Abstract] The article describes the equipment used for connection between subscriber lines included in different quantum exchanges. Block diagrams are shown of the IKB3 outgoing and VKB3 incoming line equipment. The connection procedures for the subscribers of different stations are the same as those used for connection subscribers of one exchange as described in AVTOMATIKA, TELEMEKHANIKA I SVYAZ, 1986, No 5. The principles of operation of the central control device of a Quantum station will be considered in a future number of this journal. Figures 2.

6415/9274

656.257-83

**Adjustment and Installation of Electric Centralization of Switches and Signals of Large Stations**

18600000 Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 3  
Mar 87, pp 21-25

[Article by A. P. Semiryazhko, senior electromechanic, Likovskiy District, South-East Railway]

[Abstract] The article describes in detail the experience accumulated at the South-East Railway with respect to testing and adjusting new equipment for electrical centralization of switches and signals of large stations, as well as placing the equipment in operation at sectors with much movement of trains. The procedures used for regulating and debugging to routing control system are listed.

6415/9274

656.25.071.84

**Use of Statistics-Prevention Strategy During Servicing of Overhead Communication Lines**

18600000 Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 3  
Mar 87, pp 28-29

[Article by G. V. Sidorov, chief of Signalization and Communication Service, Baltic Railway, A. I. Breydo, assistant professor, Leningrad Institute of Railroad Transportation Engineers, imeni Academician V. N. Obratztsov, candidate of technical sciences, V. A. Chirakadze, senior scientific research worker, and A. R. Aleksandrov, deputy chief, Tallin Division, Baltic Railway]

[Abstract] In 1986-87 workers of the Baltic Railway switched to a new form of management of maintenance work which assured an increase in the efficiency of the transportation process and increased the productivity of work as concerns the reliability of servicing overhead communication lines. The article describes the manner in which this was accomplished. Statistical data on line reliability is used to determine which areas require maintenance work because of local conditions.

6415/9274

**Measurement of Parameters of Stationary Radio Stations by Laboratory Car Equipment**

18600000 Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 3  
Mar 87, pp 37-38

[Article by I. I. Badyan and V. S. Shapovalenko, senior electromechanic of Laboratory of Automatics, Telemechanics, and Communication, North Caucasus Railway]

[Abstract] The article describes in detail the nonautomated process of measuring the parameters of stationary radio stations on the North Caucasus Railway.

6415/9274

**Radio Control of Switches From Locomotive**

18600000 Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 3  
Mar 87 p 39

[Article by V. B. Yagodin, scientific secretary, Section of Automatics, Communication, and Computing Technology, Scientific-Technical Council, USSR Ministry of Railroads]

[Abstract] The results of experimental operation of a device for radio control of switches from a maneuvering locomotive are described. Such devices for radio control of switches, crossings and other ground-type devices for signaling, centralization and blocking from the cab of a maneuvering locomotive are constructed and introduced into experimental exploitation at the Klinskiy Enterprise for Industrial Railroad Transport. The delivery of commands is performed by a radio channel assigned by this enterprise. A detailed description of these device was published in the Moscow journal AVTOMATIKA, TELEMEKHANIKA I SVYAZ, 1986, No 3.

6415/9274 2-15

621.395.345

**Equipment for Connection Lines of Quantum Cross-bar Type Automatic Telephone Exchange**

18600000 Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 3  
Mar 87, pp 12-15

[Article by S. L. Dyufur, professor, Leningrad Institute of Railroad Transportation Engineers imeni Academician V. N. Obratztsov, doctor of technical sciences, and A. K. Lebedinskiy, candidate of technical sciences]

[Abstract] The article describes the equipment used for connection between subscriber lines included in different quantum exchanges. Block diagrams are shown of the IKB3 outgoing and VKB3 incoming line equipment. The connection procedures for the subscribers of different stations are the same as those used for connection

subscribers of one exchange as described in AVTOMATIKA, TELEMekhANIKA I SVYAZ, 1986, No 5. The principles of operation of the central control device of a Quantum station will be considered in a future number of this journal. Figures 2.

6415/9274

UDC 621.395.74.072.9

**Use of Time Grouping Apparatus in Digital Synchronous Network**

18600025a Moscow ELEKTROSVYAZ in Russian  
No 10, Oct 87 (manuscript received 18 Mar 87) pp 3-6

[Article by V.A. Biryukov and V.P. Korneyev]

[Abstract] Reliable performance of time grouping apparatus for synchronous or asynchronous interconnection-separation of secondary, tertiary, or quaternary component channel groups, with the receivers of transmission-rate-matching command signals disconnected in the synchronous mode, depends on the probability of distortion of at least two such signals so that spurious actuation of a receiver will result. Taking this into consideration, the performance of time grouping apparatus in a digital synchronous network with those receivers disconnected but with a buffer memory included is found to be perfect and thus much better than in the synchronous mode with those receivers connected or in the plesiochronous mode with a buffer memory included. Most expedient, however, is found to be almost perfect operation in the asynchronous mode with bilateral matching of transmission rates and with 2-command control including transmission of intermediate discrete phase divergence data. Figures 3; tables 3; references 5: 4 Russian, 1 CCITT.

2415/12913

UDC 621.395.74.037.372

**Algorithmic Means of Increasing Frequency Stability in Digital Communication Networks**

18600025b Moscow ELEKTROSVYAZ in Russian  
No 10, Oct 87 (manuscript received 23 Mar 87) pp 6-8

[Article by A.A. Kayatskas and P.A. Eymantas]

[Abstract] Minimization of short-time frequency instability in a digital communication network by discrete rather than continuous oscillator tuning is considered, the time interval between successive oscillator adjustments being not longer than the period of time within which the error of phase prediction does not exceed the allowable magnitude and the short-time frequency instability caused by an adjustment command signal being

smaller than the intrinsic frequency instability of the oscillator. An algorithm of discrete frequency control is constructed on this basis, with periodic readings of the phase difference as input data and the optimum interval between successive oscillator adjustments corresponding to minimum r.m.s. error of phase and frequency estimates. The interference immunity of such a stabilization system is determined by the dispersion of these estimates, assuming that the time interval between successive phase measurements is longer than the interference correlation time. References 5: 2 Russian, 1 East German, 2 Western.

2415/12913

UDC 621.376.56

**Design and Performance Optimization of Subscriber Speech Codec**

18600025c Moscow ELEKTROSVYAZ in Russian  
No 10, Oct 87 (manuscript received 4 Oct 87) pp 11-15

[Article by V.A. Pertseva and I.V. Sitnyakovskiy]

[Abstract] Inasmuch as signals at both input and output of a subscriber speech codec are analog ones, such a codec must be combined with PCM codec for operation in a subscriber telephone network with digital transmission of speech. Adaptive differential pulse-code modulation with fixed prediction rather than with adaptive prediction according to CCITT recommendation G.721 is considered for this application, because of its simpler implementation with satisfactory fidelity assurance. The choice is based on a comparative evaluation, by computer simulation, of this and various other encoding methods such as adaptive plain pulse-code modulation and adaptive delta modulation with input-signal or output-signal control and with fixed or adaptive prediction. Overall and more precise "segmental" ratios of signal to quantization noise served as performance criteria. Subjective-statistical analysis of ratings by experts was included as basis for grading the various methods from excellent to poor, depending on the perceptibility of speech distortions relative to a perceptibility standard. Adaptive differential pulse-code modulation can be optimized for a subscriber speech codec, an essentially low-speed device (64 kbit/s) in a system where the data transmission rate is 32 kbit/s, by considering the dependence of the transmission quality on the predictor design and performance parameters. The algorithm of adaptation for such a codec is then selected according to the optimum dependence, a power-law and thus nonlinear one, of the quantization-step increment on the absolute code wordlength. Figures 5; tables 5; references 10: 6 Russian, 4 Western (1 in Russian translation).

2415/12913



UDC 621.391.037,372:621.391,833.2

**Correcting Phase Distortions in Line Channels of Digital Transmission Systems**

18600025d Moscow ELEKTROSVYAZ in Russian  
No 10, Oct 87 (manuscript received 23 Jun 86) pp 15-18

[Article by F.B. Fedortsev]

[Abstract] Use of phase correctors in line channels of digital transmission systems so as to ensure a most nearly linear phase-frequency characteristic and thus minimize intersymbol interference is examined, considering that a real channel consisting essentially of the cable or overhead line and the analog part of the repeater along with filters and corrective networks has a drooping amplitude-frequency characteristic. Insertion of a segment with constant time delay and thus linear phase-frequency characteristic does not change nature of nonlinearity of the channel phase-frequency characteristic, which allows treatment of such a transmission channel as a minimum-phase circuit. The necessary phase correction is determined with the aid of the Hilbert transformation. Calculation of the group time delay and the phase-frequency characteristic for both a corrected channel and an uncorrected one reveals that already bisectional phase correction improves the channel response to a square input pulse appreciably in terms of a much higher signal-to-interference ratio. This result is confirmed by experimental phase correction of a lumped-parameter bread-board model simulating an RLC network with an amplitude-frequency characteristic  $A(\omega) = e^{1n1/2\omega n}$  (n0) over the 0 -  $\omega$  - 2 range and  $A(\omega) = A(2) = \text{const}$  over the  $\omega$ -2 range ( $\omega$ - frequency normalized to half clock frequency). Figures 4; tables 1; references 6: all Russian.

2415/12913

**Digital Detectors of Harmonic Components in Signals With Adaptive Delta Modulation**

18600025e Moscow ELEKTROSVYAZ in Russian  
No 10, Oct 87 (manuscript received 14 May 86) pp 18-21

[Article by A.V. Brunchenko, Ye.P. Okhinchenko, and A.Ye. Sedov]

[Abstract] A digital detector of harmonic components in a discrete signal with adaptive delta modulation and syllable companding at the coder output is synthesized on the basis of spectral analysis and parameters of the coder input signal. Such a detector consists of an operating device and a resolving device, the former including an array of digital band filters with complex transfer function each and corresponding two modulus calculators with two summators. One of these summators acts as a threshold device. Multiplications and summations in the array of complex filters are implemented by a set of logic elements and two reversible counters respectively, the latter also acting as registers. The modulus calculators include another set of logic elements. The algorithm of the resolver is based on the dependence of an operator output signal on changes in amplitudes, frequencies, and phases of its harmonic components. Inasmuch as the detector input signal is nonlinear, this dependency is easier to determine on the basis of simulation than analytically. This is shown for a specific digital detector of six harmonic components with frequencies  $f_{1,2,3,4,5,6} = 700, 900, 1100, 1300, 1500, 1700$  Hz in a signal with adaptive delta modulation and a 32 kHz discretization frequency, the coder consisting of a subtractor, a quantizer, two integrators, a multiplier, and a units density analyzer. Multiplexing of channels makes possible simultaneous processing of several independent delta-modulated signals. Figures 3; references 4: all Russian.

2415/12913

**Matching Interdigital Transducers With Field of Surface Acoustic Waves in Delay Lines and in Filters**

18600000h Kiev IZVESTIYA VYSSHIKH  
UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 30, No 1, Jan 87 (manuscript received  
after revision 14 May 86) pp 69-72

[Article by A. N. Rozhdestvenskiy]

[Abstract] Suppression of parasitic efforts in SAW delay lines and filters is considered, volume acoustic waves being compensated by use of piezoelectric crystals with appropriate orientation as substrates and diffraction or reflection being compensated by use of interdigital transducers. Such transducers can also suppress second-order wave effects when properly matched to the field of surface acoustic waves. This is achieved by shaping their electrodes to conform to the phase fronts of surface acoustic waves. The effectiveness of such a design is confirmed by a performance analysis according to the geometrical theory of diffraction in the short-wave approximation, assuming a negligible mismatch between phase velocity and group velocity vectors. The field in the substrate is treated as one attributable to the array of images of point sources in the transducer electrodes. Calculations for an apodized transducer with uniformly spaced electrodes of equal widths confirm that bulk and surface waves with differently anisotropic velocities can coexist only in the far-field region. For experimental verification, an interdigital transducer was used in a filter on a YZ-cut  $\text{LiNbO}_3$  substrate. The radiator with a 1.2 mm wide aperture and 68 electrodes 120 gmm wide each was apodized according to the Hemming function. Two receivers, one on each side of the radiator, had equal apertures tuned to acoustic synchronism at the 14.5 MHz frequency and 20 electrodes each. The electrodes of one receiver were straight, those of the other were curved according to the elliptical approximation for the velocity of surface acoustic waves in the YZ-cut of  $\text{LiNbO}_3$ . Such a curving resulted in a uniform amplitude-frequency characteristic within the pass band, with a negligible ripple caused by reflections from the substrate boundary and negligible diffraction, also in a low

transmission coefficient for volume acoustic waves and a small third harmonic of acoustic synchronism. Figures 3; references 8: 3 Russian, 5 Western.

02415/09599

**Effect of Sound Modulation on Acoustic Distributed Back Coupling I ELEKTRONIKA, Apr 87]**

18600223i Moscow RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 32, No 4, Apr 87  
(manuscript received 11 Oct 85) pp 902-905

[Article by M.T. Burova and G.N. Shkerdin]

[Abstract] The article considers the basic characteristics (i.e., the natural characteristics and their excitation threshold) of the acoustic distributed back coupling (in laser media) which is produced by a modulated of the amplitude and phase of a sound wave. The authors thank Yu.V. Gulyayev for helpful council and valuable comments. References 5: 3 Russian, 2 Western.

6415/12232

**Collinear Diffraction of Light by Sound Waves I ELEKTRONIKA, Apr 87]**

18600223d Moscow RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 32, No 4, Apr 87  
(manuscript received 18 Aug 85) pp 703-709

[Article by G.Ye. Zilberman, L.F. Kupchenko, and G.F. Goltvyanskaya]

[Abstract] Based on a general theory developed earlier, this article considers a number of cases of collinear diffraction of light by sound: diffraction by longitudinal sound in certain classes of crystals with close to Bragg and dual-Bragg resonances and diffraction by transverse sound with a change of the plane of polarization in certain classes of crystals. The results of this article can be used during the basic construction of various acousto-optical devices. Figures 2; references 12: 10 Russian, 2 Western.

6415/12232

**Chamber for Deposition of Aerosols with Controllable Characteristics on Optical Components**

18600000i Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 1, Jan 87  
(manuscript received 9 Jun 86) pp 30-32

[Article by N. N. Belov, N. N. Balanovskiy, V. V. Vetrov, V. P. Zakharov, Yu. S. Zvenigorodskiy, S. A. Kudryashov, V. I. Litvinov, P. Yu. Makaveyev, P. P. Markin, and A. V. Mosenkov]

[Abstract] A test chamber for controlled deposition of aerosols on optical surfaces has been built in which a broad spectrum of contamination (atmospheric, marine, volcanic, industrial) can be simulated and its effect on the performance of optical components can be experimentally evaluated. Particles with controllable characteristics, of chemically pure substances and of 0.5-10 gmm size, are mixed with an air stream prefiltered by a Petryanov device in doses regulated by an electromagnetic valve. The aerosol generator, located above the chamber, injects the downward flowing stream with a stable and at least 15 percent large volume fraction of aerosol particles into the chamber through an orifice in

the upper compartment of the latter. That compartment is held in fixed position by brackets and tapers upward to the orifice on top. The lower compartment, in an adjustable position, is mounted on a jack screw for raising or lowering and is coupled to the upper compartment through a hermetic extensible hoop joint. Inside the lower compartment is mounted a holder rotating slowly on a horizontal shaft with several seats for flat and nonplanar optics including prisms so that several surfaces can be processed simultaneously. The aerosol deposition is controlled by flaps above the optical surfaces and by preferential orientation of the optical surfaces relative to the impinging stream. Aerosol leakage from the chamber is prevented by a Petryanov filter underneath the rotating holder. Tests were performed in this chamber with AZ-5 and Phoenix aerosol counters. A distribution of aerosol particles on optical surfaces uniform within 20 percent was attained by injection of a turbulent stream (Reynolds number approximately 4,000) and with a large ratio (approximately 6) of chamber height to maximum radius of optics array on the holder. Figures 3; references: 4 Russian.

02415/09599

**Asynchronous Motor as Electromechanical Filter of Periodical Disturbances in a System of Conversion Into Pulse Power**

18600000h Novocherkassk IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY:

ELEKTROMEKHANIKA in Russian No 3, Mar 87  
(manuscript received after revision 4 Mar 86) pp 38-42

[Article by Stanislav Romanovich Mizyurin, doctor of technical sciences, professor, Moscow Aviation Institute; Nina Vasilyevna Sineva, candidate of technical sciences, assistant professor, Moscow Aviation Institute; and Yuriy Andreyevich Ivannikov, engineer, Moscow Aviation Institute]

[Abstract] A system for conversion of ac current from the primary network to pulse power is described which utilizes an electric motor in the conversion device. A lower level for input frequencies (cutoff frequency of filters) is established, above which an asynchronous motor is an electromechanical filter eliminating high-frequency excitation. Figures 5; references: 3 Russian.

6415/9604

**Mathematical Model of Dynamics of Switching of Electromagnetic Equipment**

18600000h Novocherkassk IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY:

ELEKTROMEKHANIKA in Russian  
No 3, Mar 87 (manuscript received 8 Sep 86) pp 65-70

[Article by Aleksandr Grigoryevich Nikitenko, candidate of technical sciences, professor, Novocherkassk Polytechnical Institute; Nadezhda Ivanovna Kovaleva, candidate of technical sciences, assistant professor, Novocherkassk Polytechnical Institute; and Vladimir Yakovlevich Paliy, candidate of technical sciences, assistant professor, Novocherkassk Polytechnical Institute]

[Abstract] The article considers a mathematical model of the dynamics of switching of electromagnetic contact apparatus, with allowance made for vibration of the

contacts and armature. The process of motion is divided into a series of characteristic stages, each of which is described by a system of equations. The results of a calculation of dynamic processes on a digital computer are presented. Figures 4; references: 2 Russian.

6415/9604

**Effect of Cyclic Currents on Thermal Conditions of Safety Devices**

18600000h Novocherkassk IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY:

ELEKTROMEKHANIKA in Russian No 3, Mar 87  
(manuscript received after revision 23 Jan 86) pp 71-75

[Article by Klavdiya Nikolayevna Anikeyeva, candidate of technical sciences, assistant professor, Kharkov Institute of Railway Transportation Engineers]

[Abstract] This article describes a method for calculation of the overload capacity of safety devices during passage through them of cyclic currents. The method is developed on the basis of a theoretical analysis of thermal processes in safety devices. In many areas of application (railroad transportation, electrolysis, and others) meltable safety devices operate in cyclic (or pulse) regimes. However, the technical characteristics (nominal current, time-current characteristics) cited in catalogs and specifications are obtained with the condition of passage of sinusoidal form alternating current through a safety device in accordance with GOST 17242-79. Because of this, during use of meltable safety devices in installations with a cyclic regime of current passage, there is a difficulty in determining the permissible value of the current pulse amplitude in operating and overload regimes. Figures 4; references: 4 Russian.

6415/9604

**Method of Estimating Number of Brightness Quantization Levels of Thermovision Screen**

18600000j Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 1, Jan 87  
(manuscript received 27 Jan 86) pp 16-18

[Article by N. N. Porfiryeva]

[Abstract] The performance of a video monitor in a thermovision system is analyzed, taking into account capabilities of the viewer's eye, for estimating the minimum necessary number of brightness quantization levels which will ensure adequate information content about the thermal field of the viewed object. That number of quantization levels is determined independently by the threshold temperature sensitivity, namely minimum resolvable temperature difference, and by threshold brightness contrast perceptible on the screen. The number of brightness graduations each threshold imposes can be calculated separately without regard to the other threshold. Such a calculation, made for two elements of an object at a different temperature and assuming a noiseless thermovision channel, reveals that the threshold brightness contrast is the critical one and yields its dependence on the angular dimension of a stimulus as well as on the length of adaptation time. Numerical estimates based on typical situations and specific requirements yield sufficient quantization data for design of a thermovision system. Figures 1; tables 1; references 4: 3 Russian, 1 Western (in Russian translation).

02415/09599

**Response of Image Converter to Infinitesimally Short Pulse**

18600000j Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 32, No 1, Jan 87  
(manuscript received 27 Feb 85) pp 205-208

[Article by G. V. Kolesov, I. M. Korzhenevich, V. B. Lebedev, and A. V. Yudin]

[Abstract] A method is proposed for evaluating the response of an image converter to an infinitesimally short pulse, this response being described by Green's function in the time domain. The concept of such a response characteristic applies to linear devices and, therefore, pulse widening by Coulomb interaction is assumed to be negligible relative to the response half-width. The method covers all regions, not only the cathodic region with a uniform electric field distribution, and the entire range of photoelectron deviation from the converter axis. The method is demonstrated on an image converter with an electrostatic focusing system for operation with visible light or x-radiation surface waves. The electron transit time is expressed as a quadrinomial function of the initial electron energy and direction angles of the initial electron velocity, all irrelevant constant correction terms discarded, whereupon the appropriate distribution function of a set of random

arguments which monotonically depends on one of them is evaluated. The method is also applicable to a magnetic lens. Numerical calculations with given values of the four quadrinomial coefficients have been made on a BESM-6 high-speed computer for several x-ray surface-wave image converters. Figures 1; references 10: 9 Russian, 1 Western.

02415/09599

**Production of Optical Multimode Waveguides by Means of Thermo-optic Effect**

18600000j Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 32, No 1, Jan 87  
(manuscript received 10 Jun 85) pp 187-189

[Article by I. N. Dyuzhikov and M. N. Yelinson]

[Abstract] Production of optical multimode waveguides with large apertures by means of the thermo-optic effect has been proposed, optical channels in the waveguide material being induced by nonuniform heating. Most suitable are materials with a positive temperature coefficient of the refractive index which remains constant over a wide temperature range. Such materials used in optoelectronics are GaAs, LiNbO<sub>3</sub>, LiTaO<sub>3</sub>, Ba<sub>x</sub>Sr<sub>1-x</sub>Nb<sub>2</sub>O<sub>6</sub>. Contact heating with control of the temperature profile by means of approximately spaced heat sinking straps is the most universally satisfactory method. The heating effect can be described by the two-dimensional equation of steady-state heat conduction in the approximation of adiabatic boundary conditions at both ends of the waveguide. An experimental study of this process was made with plates of Ba<sub>x</sub>Sr<sub>1-x</sub>Nb<sub>2</sub>O<sub>6</sub> single crystal perpendicular to the ferroelectric axis. A chromium resistive thin-film heater and copper heat sinking straps deposited by vacuum evaporation. Measurements were made with an interferometer, using radiation from a He-Ne laser ( $\lambda = 0.63$  gmm wavelength). The results indicate that adequate thickness of the heat sinking straps and sufficiently low thermal conductivity of the semiconductor waveguide material are essential. When the distance between the heater and a sink strap is larger than the thickness of the semiconductor plate, then the thickness of the waveguide layer will be uniform and an entirely parabolic rather than asymmetric graded-index profile will result making the waveguide behave like a cylindrical lens. Figures 4; references 5: 2 Russian, 3 Western (1 in Russian translation).

02415/09599

**Method of Determining Equivalent Step Parameters of Graded-Index Single-Mode Fiber Optic Light Guide**

18600000j Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 32, No 1, Jan 87  
(manuscript received 22 May 85) pp 184-186

[Article by B. G. Klevitskiy, D. A. Sedykh, and A. A. Sokolovskiy]

[Abstract] Determining the equivalent step parameters of graded-index single-mode fiber optic light guide by a modification of the diffraction method is proposed, a

modification which not only simplifies measurements but also indicates the degree of equivalence. The variables in the two expressions for the mode field intensity distribution in a nondirectional fiber are varied and the equivalent step parameters calculated repetitively till the theoretical intensity distribution in the far-field zone approaches the experimental one most closely on the basis of angle discretization of the measurement. The equipment consists of a semiconductor laser such as an ILPN-203 ( $\lambda = 0.86$  gmm wavelength) with power supply, a filter for elimination of higher-order modes, a

turntable, a photoreceiver, a synchronous amplifier, an analog-to-digital converter, a stepper motor which drives the turntable, and an Elektronika D3-28 control microcomputer. The authors thank R. F. Matveyev, V. T. Potapov, and Yu. K. Chamorovskiy for helpful discussion, and V. V. Moiseyev for active assistance in building the test stand. Figures 2; references 5: 1 Russian, 4 Western.

02415/09599

**Speed of Analog-to-Digital Converters With Electrooptic Traveling-Wave Modulators**

18600000j Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian* Vol 32, No 1, Jan 87 (manuscript received 28 Jun 85) pp 148-154

[Article by V. B. Baglikov, V. A. Dianova, Ye. R. Mustel, and V. N. Parygin]

[Abstract] The modulation band of optoelectronic analog-to-digital converters with interferometric electrooptic modulators can be extended by using such a modulator in the form of a traveling-wave line. The speed of these analog-to-digital converters is then limited not only by the finite time of light wave and modulating wave interaction but also by attenuation of the electric wave and by the velocity difference between the two waves. The effect of both influencing factors is evaluated for a 4-digit converter on a  $\text{LiNbO}_3$  crystal with a corresponding array of four Mach-Zender interferometers followed successively by a photodiode, an amplifier, and a comparator each, the reference signal coming to each comparator from a generator through another photodiode and amplifier set. The phase difference between light waves in two interferometer arms is calculated, assuming that the light signal and the analog signal propagate in the same direction. The dependence of this phase difference to be compensated, and thus of the upper cutoff frequency of the converter, on the ratio of light wave velocity to modulating wave velocity and on the attenuation equal to the product of path length and attenuation coefficient indicate the optimum spacing and lengths of electrodes on the  $\text{LiNbO}_3$  crystal. Numerical data and calculations yield an upper cutoff frequency of 150 MHz with the longest electrode 2 cm long. Figures 3; references 7: 4 Russian, 3 Western.

02415/09599

**Adiabatic Model of Multimode Fiber Optics for Calculation of Their Pulse Response**

18600000j Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian* Vol 32, No 1, Jan 87 (manuscript received 29 Aug 85) pp 54-61

[Article by V. N. Tutubalin and A. D. Shatrov]

[Abstract] An adiabatic model of quasi-regular multimode fiber optics is constructed which includes slow variation of refractive index profiles along the light propagation path. In this model the light beam represents a group of confluent modes describable by the single parameter  $gy = n^2 \cos^2 \theta$  ( $n$  - refractive index,  $\theta$  - angle between light beam and fiber axis) which is a function of the longitudinal coordinate. This function  $gy(z)$  satisfies the fundamental equation  $dgy/dz = A(gy, z)$ , where  $A(gy, z) = 2 [R_2^2(gy, z) - R_1^2(gy, z)]^{-1} R_1(gy, z)$  to  $R_2(gy, z)$  ( $gdn^2(r, z)/gdr$ ). Here  $n(r, z)$  is the mean-azimuthal refractive index in a cross-section,  $r$  is the radial coordinate, and  $R_1, R_2$  are the two roots of the equation  $n^2(r, z) = gy$  ( $R_1 = 0$  when the equation has only

one root). On the basis of this model are calculated the transient function and the pulse response of such fiber optics. A preliminary analysis of the results indicates a close correlation with earlier measured pulse responses of real multimode fibers. The authors thank R. F. Matveyev for interest. References: 5 Russian.

02415/09599

**Physicotopological Model for Calculation of Density of Defects of Large-Scale Integrated Circuits**

18600000i Moscow *MIKROELEKTRONIKA in Russian* Vol 16, No 3, Mar-Apr 87 (manuscript received 2 Oct 85) pp 112-118

[Article by I.P. Lazarenko and V.I. Moshkin]

[Abstract] The article proposes a physicotopological model for calculation of the probability of obtaining suitable crystals, based on the introduction of new assumptions as to the constant value of density defects which depend upon the distribution of the configuration of the topological elements with respect to the surface of the crystal. The following items are considered in detail: 1) Generalized topological parameters of large-scale integrated circuits; 2) Connection of generalized topological parameters with physical mechanisms for origin of defects; and 3) Computer experiment for testing of proposed physicotopological model. Figures 3; references 7: 3 Russian, 4 Western.

6415/9604

**Evaluation of Effectiveness of Methods of Designing Large-Scale Integrated Circuits**

18600000i Moscow *MIKROELEKTRONIKA in Russian* Vol 16, No 3, Mar-Apr 87 (manuscript received 7 Aug 86) pp 119-121

[Article by A.G. Aleksenko and N.A. Samotayev]

[Abstract] The article is concerned with a well-founded choice of the preference criterion (effectiveness) by which it is possible to obtain the optimum relationship of essential quality indices, and thereby to select a method of designing large-scale integrated circuits. On the basis of the criterion obtained, a comparison is made of the made-to-order and matrix methods of designing with method of designing devices based on printed circuit boards with the use of series-produced integrated circuits with a small and medium degree of integration. The main features of the criterion are discussed and its use is illustrated by evaluations of designs of a digital voltmeter and a controller. Figures 3; references 5: 4 Russian, 1 Western.

6415/9604

**Investigation of Domain Structure of a Rectangular Application Under the Action of External Fields**

18600000i Moscow MIKROELEKTRONIKA in Russian  
Vol 16, No 3, Mar-Apr 87 (manuscript received  
27 Apr 86) pp 170-175

[Article by V.S. Semenov, Institute of Control Problems]

[Abstract] Charged and noncharged domain boundaries play a basic role in the processes of reversal of magnetization of thin magnetic films, particularly in domain memory devices. The article theoretically investigates the domain structure of a rectangular application under the effect of an external magnetic field of arbitrary direction. On the basis of minimizing the energy of the application, the equilibrium domain structures of the rectangular application are obtained. The distribution areas are determined for magnetic bulk charges which are the sources of the leakage fields of the application. The author thanks N.P. Vasilyevoy, Ye.I. Ilyashenko and Yu.F. Sokolov for help in preparing the article. Figures 5; references 5: 2 Russian, 3 Western.

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**Basic Problems in Development of Automated Design Systems for Very-Large Integrated Circuits for Electronics Equipment**

18600000i Moscow MIKROELEKTRONIKA in Russian  
Vol 16, No 3, Mar-Apr 87 (manuscript received  
15 Oct 86) pp 176-180

[Article by B.V. Batalov, V.G. Nemydrov, V.A. Shepelev, and A.I. Kornilov]

[Abstract] The article considers the problems of constructing automated design systems, oriented to the development of a large list of very-large integrated

circuits of frequent application. The contemporary state of the problem is shown and current means for solution of these problems are discussed. The following items are considered in detail: 1) Functional description and synthesis of logic units; 2) Synthesis of topology; 3) Physicotopological design of components; and 4) Integrated automated design systems for very-large integrated circuits. References: 3 Russian.

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**Wide-Band Filters Based on Surface-Acoustic-Wave Waveguides**

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Vol 16, No 3, Mar-Apr 87 (manuscript received  
5 May 86) pp 184-186

[Article by O.A. Maltsev and I.P. Nikitin, Institute of Radio Engineering and Electronics, USSR Academy of Sciences]

[Abstract] Experimental investigations concerned with the possibility of creating wide-band filters of extremely small dimensions, with a prescribed amplitude-frequency-characteristic, and based on surface-acoustic-wave waveguides, show that this technology is promising for microelectronics devices. Figures 2; references 3: 2 Russian, 1 Western.

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